This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

UC-NRLF
$B 124 846

LIBRARY OF THE UNIVERSITY OF CALIFORNIA
Berkeley

Berkeley

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

A TEXT BOOK ON PERSPECTIVE

By

EDWARD S. PILSWORTH

REESE LIBRARY
OF THE
UNIVERSITY
OF CALIFORNIA

Published by School of Applied Art,
Battle Creek, Michigan

Copyright, 1900, by Edward S. Pilsworth
All rights reserved.

PREFACE.

Inasmuch as it appears customary for the author of any book to write a preface explaining his reasons, motive, etc., we shall adhere to the regular practice. Besides, we have something to say worthy of your attention.

The primary object of issuing this book is to advertise our institution. Up to the present, there has never been printed a plain, simple, authentic, practical book on the subject of perspective. Nor is there any book on the subject, of any value, that can be purchased at a reasonable price. As we supply this demand, we think we are entitled to the consideration of the artistic public, especially students and amateurs.

The book is composed of the two instruction papers on perspective from our regular courses. The practicability of the system is plainly shown throughout. The effort, and it has been considerable, has been to make everything clear and practical, largely by giving, as far as possible, what may be termed living illustrations. It contains no abstruse mathematical figures, but is illustrated with subjects familiar in every-day life.

This work is the only part of our instruction that is to be had except by our regularly enrolled students. Perspective is a very small part of what we teach, but the same simple, practical method of instruction is followed throughout in all branches of our courses. Our stu-

82990

dents work out and send in for criticism and correction the problems given on pages 32 and 50. This privilege is not extended to others. If, however, there are any points not clear, we will elucidate them free of charge, if you will write us regarding them. We undertake to answer one letter only from any one purchaser, so whatever questions you desire to ask must all be included in the one letter. The preceding is not to be construed as a confession of either incompleteness or lack of clearness in the book. The majority will have no trouble whatever in understanding the work, but there is always a possibility that some one may fail to comprehend some particular point. Our students have no trouble, nor do we anticipate any for our readers.

Now, if, after a study of this book, you are satisfied that our system of teaching is thorough and practical, and you wish to enter further into the study of drawing, we shall be very glad to correspond with you. And while, as we stated at first, business rather than sentiment has led to the issuance of this book, yet we like appreciation. If the work pleases you, a line or two to that effect would be acceptable indeed.

If you have followed us thus far, we earnestly thank you for your kind attention.

Sincerely,
SCHOOL OF APPLIED ART.
E. S. PILSWORTH, *Art Director.*
E. V. TUTTLE, *Manager.*

Direct
Perspective.

TO THE STUDENT.

Perspective has been described as the art of correctly representing appearances.

In drawing objects to which there is length, breadth and thickness, the object is not drawn as it is, but as it appears. For instance, in drawing a cube, while we know the cube has six sides, we do not draw six sides; because at the most we can only see three; sometimes two, and if the point of view of the spectator is directly over or in front of one face of the cube, only one side.

A knowledge of the various rules that apply in perspective is very necessary to the artist. Bad perspective will spoil any drawing, no matter how good it may be otherwise. It is comparatively modern in its conception. The work of the Ancients, of most Medieval artists, and of the Japanese and Chinese among moderns, shows no correct knowledge of perspective. A glance at a reproduction of a painting of some of the old Italian masters, or at some Japanese drawings, will show the crudity of their knowledge in this respect. The old willow pattern Chinaware of our grandmothers is a good illustration.

Perspective is almost unique in the studies of an artist, as it admits of complete mathematical demonstration. The perspective taught in the following paper is direct perspective, or the perspective of lines running directly away from the observer. In addition to this there is angular, oblique, light and shadow perspective; but direct perspective only will be treated of in the following pages.

The student must not think that he will work out all drawings he may have to make, by mathematical lines. The object is to give him a complete knowledge of the principles that underlie the study of perspective, and ground him in basic laws of drawing.

If the pupil studies this paper carefully, he will discover the reasons for many curious details in drawings, that before he did not observe, or did not understand. The study is interesting and necessary. A thorough knowledge of perspective will enable the student to avoid many of the errors that are frequently found in the drawings of incompetent artists.

DEFINITIONS AND ABBREVIATIONS.

A plane is an even flat surface of any possible breadth or length but no thickness.

Projection is the representation of objects on a plane by means of straight lines, representing rays of light.

Linear Perspective is the drawing on a plane surface of some object viewed from a particular point.

The axis of vision, or principal visual Ray, is the ray that is directly in front of the spectator, running from his eye to the center of vision. It is in reality the center or axis of the cone of rays.

A Vanishing Point is a point to which parallel lines converge. The C. V. is the only vanishing point in this paper.

Vanishing Parallels are parallel lines running to the same vanishing point.

Distance Points are the points by which all distances back of the Picture Plane are measured and are represented in the plates as D. and D′.

P· P.	Picture Plane.
C. V.	Centre of Vision.
V. L.	Vanishing Line.
P. L.	Picture Line.
‡V. P.	Vanishing Point.
†M. P.	Measuring Point.
D. D1.	Distance Points.
Van. P.	Vanishing Parallel.
°	Degrees.
′	Feet.
″	Inches.
P. V. R.	Principal Visual Ray.

---

‡In this Paper the C. V. is the only vanishing Point.

†In this Paper D. and D1. are the only measuring Points.

THE LIBRARY OF THE UNIVERSITY OF CALIFORNIA

GENERAL INSTRUCTIONS.

Unless refracted, light travels in straight lines. This is one principle upon which perspective is founded. The rays of light are represented in the perspective drawing by straight lines. These rays of light converge to the eye, and if a transparent vertical plane be interposed between the eye and any particular object, it intersects these rays and a perspective representation can be formed on it by joining the rays reflected from the object.

It will be readily seen that rays of light coming from every direction and centering in the eye form a cone. The intersection of this cone by the picture plane forms the base of the cone of rays.. This is explained by Fig. 1, where A. B. C. D. is the picture plane. It will be also apparent that any object at the back of P. P. within the range of vision, will be represented in some form or other, depending on the position of the object inside this base of cone of rays. The angle of vision formed by this cone of rays is 60°.

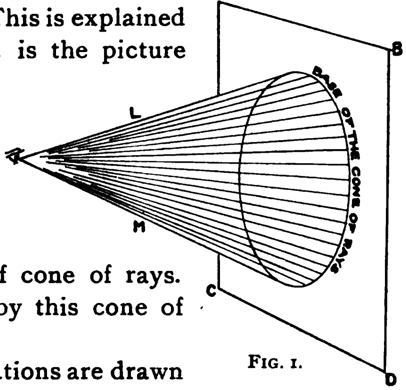


FIG. 1.

All perspective representations are drawn as though looked at by one eye only. The reason for this is that images so seen are sharp; whereas if both eyes are used, only the object, or if a large one, only a portion of the object directly viewed is sharp. To illustrate, take a match, close one eye, and hold the match with the end toward the eye so that only the sulphur head is visible; then open the other eye. One side, in addition to the head, will be instantly visible.

Also stand at the back of a room and view the landscape through the window. The landscape, if looked at directly, will be sharp, but the sides of the window will be doubled. If the window is looked at, the landscape is doubled. If one eye be closed everything is sharp. The use of both eyes enables us to judge distances. For the reasons stated above one eye only is used in linear perspective.

Objects of equal magnitude, placed at the same distance from the eye, appear equal in size. If one is placed behind the other it looks smaller, and the farther away it is placed the smaller it looks.

This is explained by Fig. 2, where the two spheres are equal in size.

We have here a diagram showing the eye with the outermost rays of light from the top and bottom, respectively lettered L. and M., and corresponding to the lines marked L. and M. in Fig. 1. Also two dotted lines, A. B. and C. D. Now A. B. takes in the whole space of the vertical vision, as does C. D.; but although A. B. is only half the length of C. D. it still looks as long as C. D. because that also takes in only the vertical range. *That is to say, that any line running the whole length of the space between the lines L. and M., no matter how far or near the eye, looks equally as long as any other line, running the whole space, no matter how far or near it may be.*

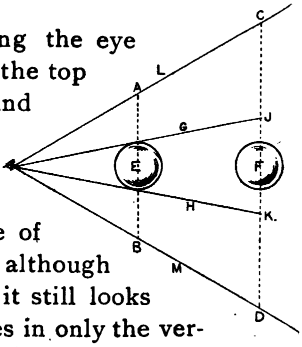


FIG. 2.

As an example, suspend a yard stick vertically against the wall, stand a few feet away and hold a lead pencil, so that the top and bottom of the pencil are coincident with the top and bottom of the yard stick. The pencil, though so much shorter, looks equally as long as the yard stick.

If the student thoroughly understands the foregoing we will return to a study of Fig. 2. If not, read it again until the principle explained is comprehended.

It being taken as proved that the lines A. B. and C. D. appear of equal length to the eye, we are able to determine the apparent sizes of the spheres E. and F. A comparison of the diameter of the sphere E. with the length of the line A. B. shows us that it is as 1 to 3. A like comparison of the sphere F. with the line C. D. shows us that it is 1. to 6. Consequently if the sphere E. is equal to ⅓ the length of the line A. B. while the sphere F. is only ⅙ of the line C. D., E. must appear twice as large as F. We will proceed to prove it by running the lines G. and H., from the eye along the upper and lower surfaces of E. until they cut the line C. D. at J. K. where, as stated above, the part thus enclosed will look the same size as the vertical diameter of E. Upon measuring the distance between J. K. we find it just twice the size of F.

The horizon is always on a level with the eye of the spectator. That is, if a man sit on the ground on a flat plane and look straight ahead, the horizon will appear about 2½ feet above the ground he sits on; if he stands up, it will appear to rise with him to about five feet; if he elevates himself upon some object so that his eye is 10 feet above the ground beneath him, the horizon line will rise to 10 feet likewise. All straight lines running directly away from him converge at a point on the horizon directly level with his eye. If we imagine a man standing in the middle of a railroad track, as in Fig. 3, the railroad track running directly away from him, to the horizon, the ground at his feet being 5 feet lower than his eyes, we see that the railroad track has (in our perspective representation) to rise 5 feet.

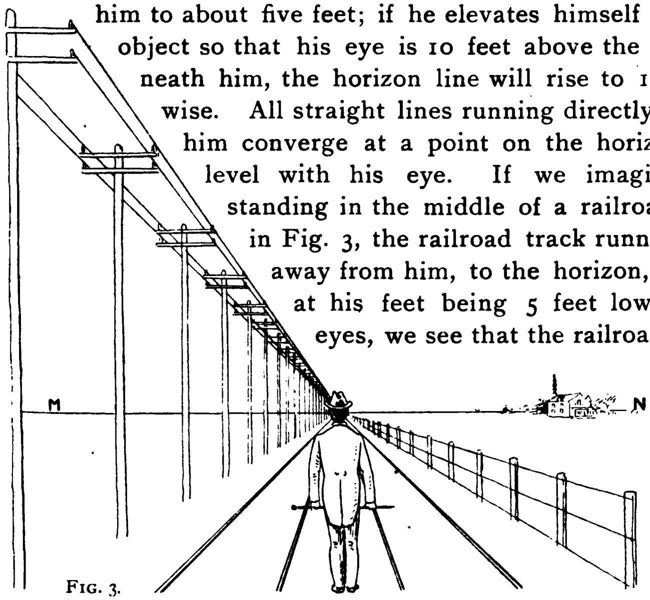


Fig. 3.

Supposing the fence at the right to be 3 feet high, it must rise 2 feet; a line drawn through the lower ends of the telegraph poles, resting as they do upon the ground, must rise 5 feet, as do the track rails. Now supposing the telegraph wires to be 15 feet above the ground, since the man is only 5 feet high, and all lines running directly away from him converge at a common point on the horizon, the wires must drop 10 feet.

All direct perspective is summed up in this drawing, and may be stated concisely thus:—

The horizon is always on a level with the eye.

All lines forming the boundaries of objects running away from the spectator come to a point on the horizon.

All lines forming the boundaries of objects running *directly* away from the spectator come to a point directly opposite his eye on the horizon.

All such lines beneath his eye *rise* to this point.

All such lines above his eye *drop* to this point.

This does not apply to mountainous countries, as there the horizon is artificially elevated.

There is no perspective on lines parallel to the front of the spectator (this term really means, parallel with the horizon line) or on vertical lines. The reason for this is illustrated in Fig. 4. We have here two men standing at A. and B. respectively. C. represents the front of a building, while the lines L. and M. and L′ and M′ represent the limit of the vertical vision. If a man at A. is looking at the front of the building, he sees no vertical perspective because the space is too small to allow of any; the vertical amount of the building that is within the range of his vision is so small that no vertical perspective is visible. If we remove

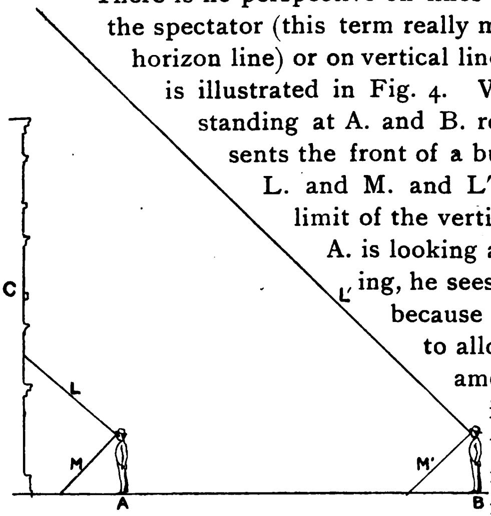


Fig. 4.

the man to B., he will see more of the front, it is true, but he will be so far away that he will see it all at once; that is, it will all come inside the base of the cone of rays; and as we have explained already with regard to vertical lines in Fig. 2, it cannot be larger than the space he sees when he stands at A.

He may, where he stands at A., lean his head back and look up along the face of the building to the top; but if he does this, he practically changes the front to a ground plane, and it must be so considered. He no longer views it as a vertical object.

The same applies to lines parallel to the front of the spectator. If he views them directly he sees no perspective. as they are parallel to the horizon, while if he moves his position so as to enable him to look along them, they cease to be parallel, for he has changed his Center of Vision on the horizon to a point at the ends of these lines, and the parallel lines now run directly away from him.

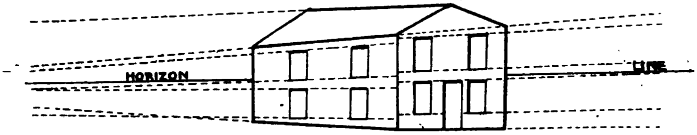


Fig. 5.

In Figs. 5 and 6 we give two drawings of the same house, one of which (Fig. 5) is drawn in bad perspective, while the other (Fig. 6) is good.

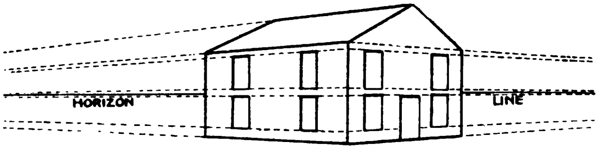


Fig. 6.

Comparing Fig. 5 with Fig. 6 we see first that the shapes of the roofs are altogether different. In Fig. 5 we have the roof larger at the distant end than it is at the near end. Since all parallel lines vanish to the same point, this must be wrong.

Turning to Fig. 6 we see that the lines on the sides from the ridges of the roof, the eaves of the roof, the tops and bottoms of the two rows of windows and the ground line of the house, all run off at gradually increasing angles and if extended out far enough would all reach the horizon at the same point. Comparing Fig. 5, the ridge line makes one angle, the eave line another, the windows still another, while the ground line would touch a still different point on the horizon. Examining still closer we see that the vanishing line of the lower part of the second story windows would not touch the horizon at all but drop below it. Since the sills of the windows are above the horizon this of course could not happen.

Considering the front we find the same troubles. The vanishing lines of the eaves, and the upper story windows run away from the horizon line instead of into it; while the lower windows and the ground line touch different points on the horizon. The front of Fig. 6 will be seen to be altogether different. Every line runs easily away and all center at one point on the horizon as they should do. It will be noticed that as the horizon line cuts the house in the space between the two rows of windows, the spectator must be somewhat elevated, his eye necessarily being level with the horizon.

The picture plane is a transparent vertical plane interposed between the eye of the spectator and the object to be drawn. In this case, the paper on which the work is done takes the place of the picture plane.

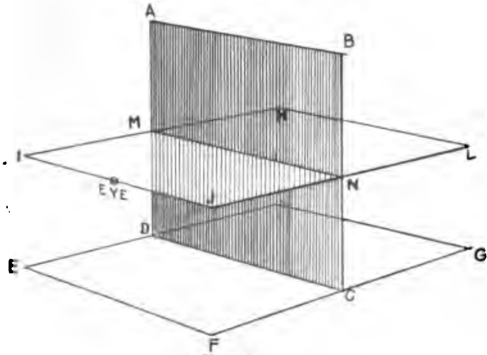


Fig. 7.

The ground plane is the plane upon which rests the object to be drawn.

The vanishing plane is an imaginary plane running from the eye to the horizon.

These planes are shown in diagram, Fig. 7.

In this paper the P. P. is always represented as vertical. In some cases of oblique perspective it may be in other positions. The picture plane must always be at right angles to the axis of vision.

A. B. C. D. is the picture plane.

E. F. G. H. is the ground plane.

I. J. K. L. is the vanishing plane.

(•) represents the eye.

M. N. is the vanishing line of the ground plane, or the horizon line; because it is the intersection of the picture plane and vanishing plane, and being on a level with the eye, the ground plane must rise to it. It is practically the line marked M. N. in Fig. 3.

This is sometimes called the "Line of Direction," because it shows in which direction the spectator views the object. The principal visual ray is the axis of the cone of rays, and runs from the eye to the vanishing line; which it cuts at C. V., Fig. 8. This point C. V. is the Center of Vision.

Distance points are set off on the horizon line at a distance each side of the C. V. equal to the distance of the eye in front of P. P. They are indicated in Fig. 8 by P. and R., and are drawn by placing the point of the compass in C. V. and describing a semicircle through the eye.

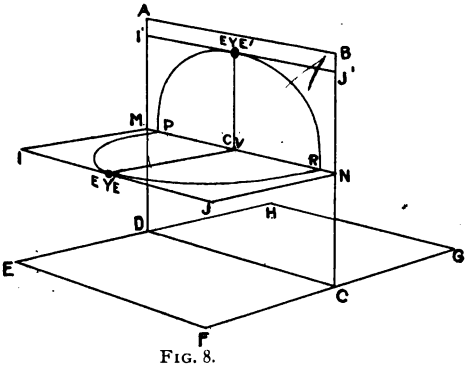


FIG. 8.

In Fig. 9 (p. 10) we have a side elevation of our various planes. B. C. is the picture plane, F. G. the ground plane, and K. L. the vanishing plane.

On the ground plane we have three rods H. I. J. To obtain a knowledge of the size these rods will look upon the picture plane, W. run lines between the various ends of the rods and the eye. Filling in the space between the light rays or lines, we get H′. I′. and J′., diminishing in size according to the distance of the rod from the eye.

We also see here a reason why the horizon is level with the eye. The rod nearest the eye is lowest on the picture plane,

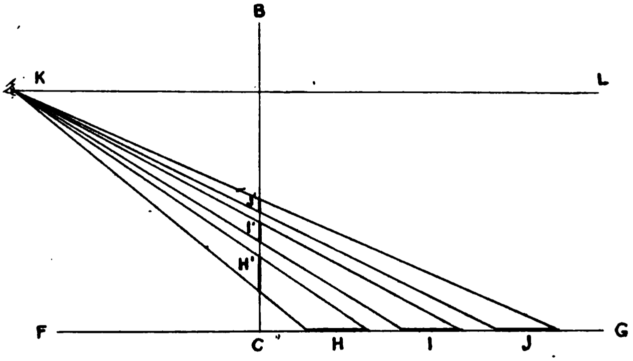


FIG. 9.

the rod farthest away the highest. If we were to put one farther back still, it would reach yet higher. If we carried it far enough back we would have to use the line J. L. as a light ray, which would bring the line to the horizon.

PREPARATION OF THE PAPER.

As previously stated the paper on which the perspective drawing is made takes the place of the picture plane, consequently the paper will represent the perpendicular plane, A. B. C. D., in Fig. 8. We see further that the vanishing plane projects in front of the picture plane, as at I, J. This plane being necessary to the working of any problem in perspective and it being very evident that we cannot, with advantage, get another piece of paper projecting from the surface of our picture paper, we overcome the difficulty by revolving the vanishing plane, as it might be, on hinges at M. N., until it lays flat against the picture plane as shown at I′. J′, carrying our P. V. R. with it. This makes no difference in the working of any problem as the P. V. R. or axis of vision, still remains perpendicular to the horizontal line, M. N.

In laying off our drawing we take some convenient scale, say ½ inch to the foot, and draw everything to this scale. While studying what is said below, the student will refer to Fig. 8, as well Fig. 10; the lettering is the same in both cases.

Commence, see Fig. 10, by making the ground line D. C. about 1½ inches from the bottom of paper (this Fig. is not drawn to this scale. The scale is 3-32 inch to the foot). If the eye is 5 feet above the ground, make the horizontal line M. N. parallel 2½ inches above it. Assuming a point of view 12 feet

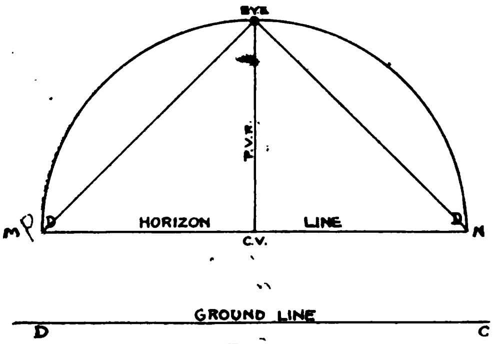


FIG. 10.

REESE LIBRARY OF THE UNIVERSITY OF CA.

in front of the picture plane, set compass to a six inch radius, and with C. V. as a center, describe the semi-circle P. R. above it. Then taking a triangle, make a line perpendicular to the horizontal line, from the point where the compass leg stood to the semi-circle; this point will be the C. V., and the point where the line cuts the semi-circle the eye.

The spectator's eye is 12 feet in front of the picture plane, and 5 feet above the Ground Line. D. and D'. at ends of the semi-circle will be the measuring points throughout this paper, and their measuring value will be now explained.

The P. V. R. makes an angle at 90° with the picture plane and horizon line, and all lines running directly away from or perpendicular to the picture plane vanish to the same point as this line, the C. V.

The lines running from D. and D'. to the eye make angles of 45° with the horizontal line and picture plane; so all lines running at the angle of 45° vanish to one or other of these points.

In the appended Fig. 11 we have a square, where the lines I. G. and J. H. are perpendicular to the line I. J. and the diagonal lines I. H. and J. G. are at angles of 45° degrees with the lines I. J. Imagine the square to be flat on the ground and the line I. J. as parallel to the picture plane, it is parallel to the ground line and horizon line in Fig. 10. The lines I. G. and J. H. will vanish to C. V. necessarily, as they will be perpendicular to these lines. Likewise the diagonal lines J. H. and G. J. will vanish to D. and D'. respectively.

This being understood the student will proceed to study plate 1 and the instructions pertaining thereto.

If the student has trouble in working out any of the following plates, further study of the General Instructions should simplify the matter.

The scale of the plates following is ¼ inch to the foot, which, while perfectly satisfactory for illustrations, is too small to draw with advantage; ½ inch to the foot is better.

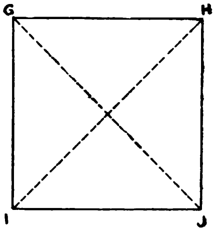


FIG. 11.

MATERIALS.

The materials required for the work in this paper are as follows, and may be purchased of us at the prices quoted, if desired:

1 pair 5½″ Compasses, with pen, pencil, needle point and lengthening bar,	$2.00
1 Drawing Board,	45
1 T Square,	25
1 30°x60° Triangle,	16
1 45° Triangle,	20
½ doz. Thumb Tacks,	05
Paper, like sample enclosed, per sheet,	02

The student may easily make his own drawing board, a flat, smooth, soft wood board with one edge straight is all that is required. Use the T square on this edge, to draw all horizontal lines. Vertical lines may drawn by the use of the triangle, held against the blade of the T square (see Fig. 12). The edge of the triangle or the blade of the T square may be used as a straight edge to draw the oblique lines.

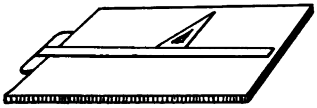


FIG. 12.

These exercises need not be inked in. The pen point for compasses, however, will be needed in ensuing papers. The plates should all be drawn in with the 3 H pencil, and the figures or objects then strengthened with the F pencil.

INSTRUCTIONS FOR DRAWING PLATE 1.

The spectator is 10′ in front of the Picture Plane and his eye is 5′ above the Ground Plane.

Fig. 1. Place a 4′ square lying on the ground into perspective. The nearest corner 2′ to left of spectator and one side parallel to and touching the Picture Plane.

Prepare the paper as shown in Fig. 10 of the text. Next mark off 2′ on Ground Line to the left of P. V. R. for the nearest corner, then 4′ to the left of this point, the space between the two points represents the side, A. B. Now as explained on preceding page, "All lines forming the boundaries of objects, running directly away from spectator converge at a point directly opposite him on the horizon." The sides of the square, as stated in the problem, A. C. B. E. are perpendicular to A. B. and will consequently converge at C. V. Next draw lines, or vanishing parallels, from A. and B. to C. V. Somewhere on these lines will be found the further points E. and C. As previously explained, all lines vanishing at an angle of 45° such as the diagonals of the square, Fig. 3, converge at D. or D′. Thus the further side of the square can be found by drawing these diagonals from the corners A. and B. of the square to D. and D′. Where these diagonals intersect the vanishing parallels, will be the further corners, which will be 4′ back of the P. P.

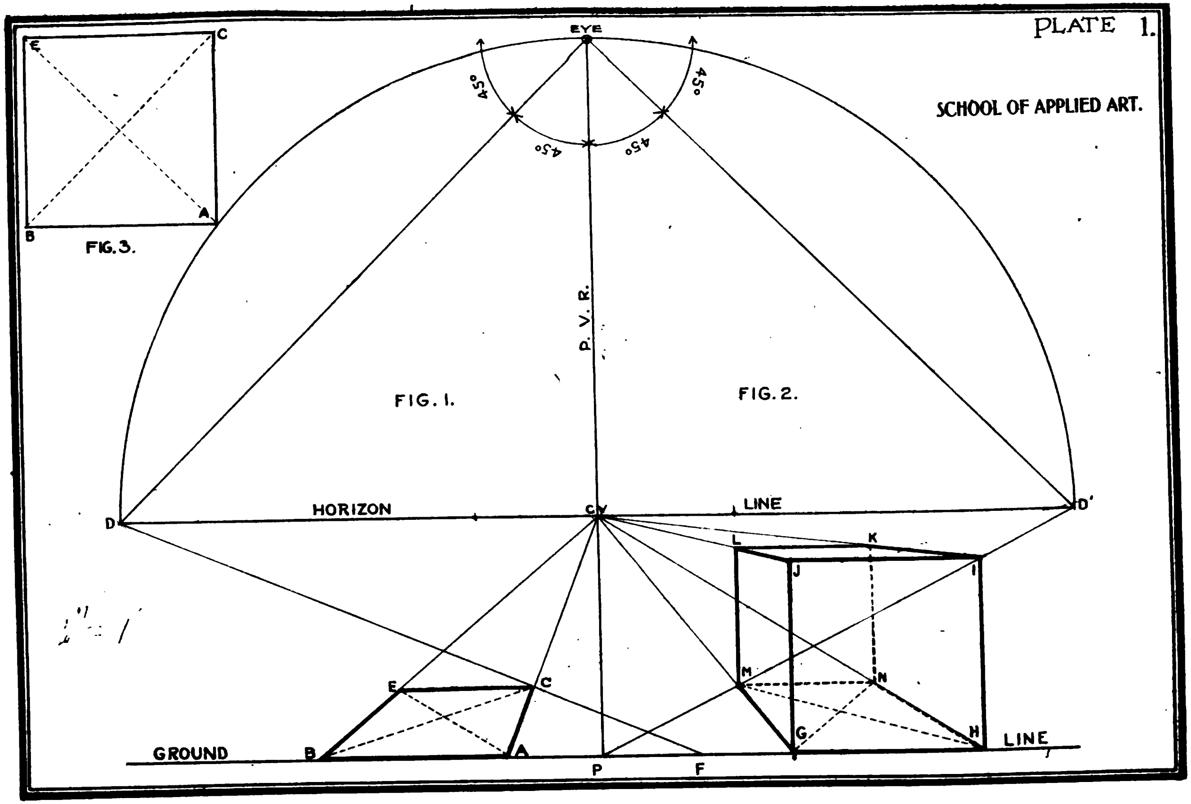
Some shapes however are not square, and a method of measuring distances back of the P. P. is necessary.

It will be seen from what is stated above that if a line runs to C. V., and it is desired to find a point 4′ back of P. P. on this line, mark off 4′ on the Ground Line and draw a diagonal to D. or D′. The point where it intersects the vanishing line will be the point required. It is immaterial on which side of the vanishing line the measurement is made, the only requisite being that the measuring line be drawn to the distance point on the opposite side of the vanishing line. In the case of Fig. 1, mark off 4′ to the right from the nearest corner A. giving point F. Drawing a diagonal to D. locates the point C., where this diagonal intersects the line from A. to C. V., this then is the limit of the right side of the square.

As there is no perspective on lines parallel to the vision, draw a line from C. to the line B., C. V. parallel to the Ground Line, and where it inter-

PLATE 1.

SCHOOL OF APPLIED ART.



sects that line is the remaining corner of the square. Care must be taken that the line C. E. is parallel to A. B.

There is no difference in finding the point C. in either method, except that in one the diagonal is run from within the square, and in the other from without.

Fig. 2. Draw a 4′ cube in perspective lying on the ground, one edge flush with the Ground Line, its farthest corner 8′ to right of spectator.

Proceed as in Fig. 1, to find a point on the Ground Line 8′ to right of P. V. R. which will be H. If H. is 8′ to the right, and the farther point of the cube, and the cube is 4′ long, then mark off 4′ to left of H. and find point G. Running verticals from G. and H. 4′ high, find points J. and I. Join these points, forming the face of the cube.

Then as the sides of the cube are perpendicular to the P. P., draw lines from G. H. I. J. to C. V., and somewhere on these lines are the points that mark the corners of the farther side of the cube. To get these, mark off 4′, the length of the side, to left of G., finding P. from which draw a line to D′. The point M. where this line intersects the line G., C. V., is the corner of the cube. From this point draw a line parallel to G. H., thus finding N. where this parallel line intersects the line H., C. V., this locates the ground plan, G. H. M. N. From M. N. draw vertical lines, and the points where they intersect J., C. V., and I., C. V., are the corners of the further side and top; connect these points and the cube is complete.

This problem could have been worked out by getting the ground plan first, and then drawing vertical lines from each corner. Nor was it necessary to mark off measuring point P. to find the depth of the cube. It could have been determined by either of the diagonals G. N., or H. M. The reason that this solution is given is that it is desired to familiarize the student with the use of measuring points.

INSTRUCTIONS FOR DRAWING PLATE 2.

It will be noticed that the form of preparation of the paper has been changed. Instead of describing the semi-circle representing the distance of the eye from the Picture Plane over the Picture Plane, it is drawn under. It makes no material difference which way it is drawn, as the P. V. R. is perpendicular to the horizon in either case, and the Distance Points fall in the same places.

It is customary to draw the semi-circle underneath, as it saves space and makes the drawing more compact.

Fig. 1 is a rectangular prism 2' square and 6' long; it lies on the Ground Plane wholly to the left of spectator, its nearest corner being 2' to left of P. V. R., and one of its sides is flush with the Picture Plane. The eye is 4½' above the Ground Plane and 11' in front of the Picture Plane.

Proceed as formerly, mark off A. 2' to the left of P. V. R. and draw a line to C. V., then the length of side 6' to left of A. locating B., and draw a line to C. V., then connect A. and B. Next mark a measuring point 2' to right of A. locating J., and draw a line to D. This determines one corner of the farther side of rectangle, as the ends are 2' square. From C. run a line parallel to A. B. until it intersects line B., C. V., at I. and the Ground Plane of the prism is established.

Next, proceed to draw the face that is flush with P. P. Draw vertical lines from A. and B. 2' high, locating E. and H. Connect these and this face is complete. From E. and H. draw lines to C. V., then from C. and I. draw verticals until they intersect these lines at F. and G. and the prism is finished.

Fig. 2, is the same prism standing on one end on the Ground Plane, wholly to right of spectator, with one of its sides flush with the P. P., its nearest corner being 3' to right.

Proceed as before, locate A. 3' to right of P. V. R. on Ground Line, then a point B. 2' to right of A. and connect both points with C. V. and with each other. As the plan of prism will be 2' square, mark a point G. 2' to left of A. and draw a line to D'. locating E. Draw a line from E. parallel to A. B. and where it intersects the line B., C. V., at F. is the farthest corner of base of prism. From the corners A. B., draw vertical lines 6' high and connect the upper ends, and the front face is now enclosed by A. B. H. I. From H. I. run lines to C. V., draw vertical lines from E. F. until they intersect these lines, connect the points of intersection and the prism is complete.

It will be noticed that in this figure the upper edges K. H. and J. I. of the prism, if continued, would vanish at C. V. the same as the base. This is the same principle that was explained in Fig. 3 of the text, in respect to the top of the telegraph poles.

It forms a special figure in Fig. 1, of next plate.

REESE LIBRARY OF THE UNIVERSITY OF CALIFORNIA

PLATE 2.

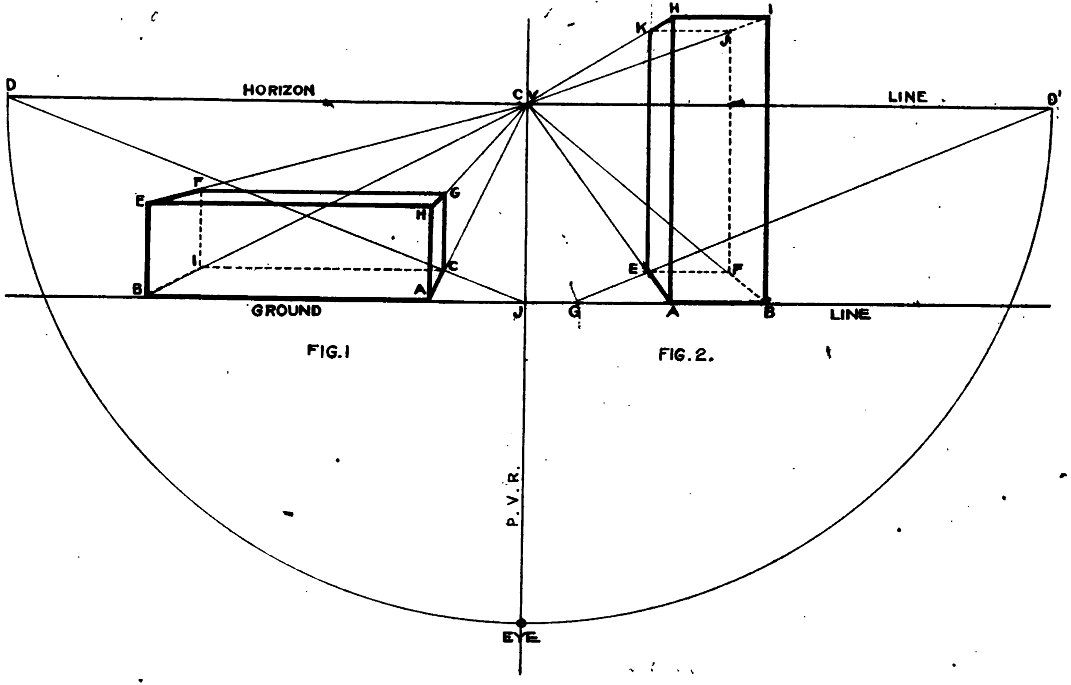


FIG. 1

FIG. 2.

SCHOOL OF APPLIED ART.

INSTRUCTIONS FOR DRAWING PLATE 3.

In this plate the eye is 11′ in front of the Picture Plane and 5′ above the ground.

Fig. 1 is a square tile in a ceiling 8′ above the ground, its nearest side is 2′ back of Picture Plane, it is wholly to left of spectator, its nearest corner being 3′ to left. It is 5′ square.

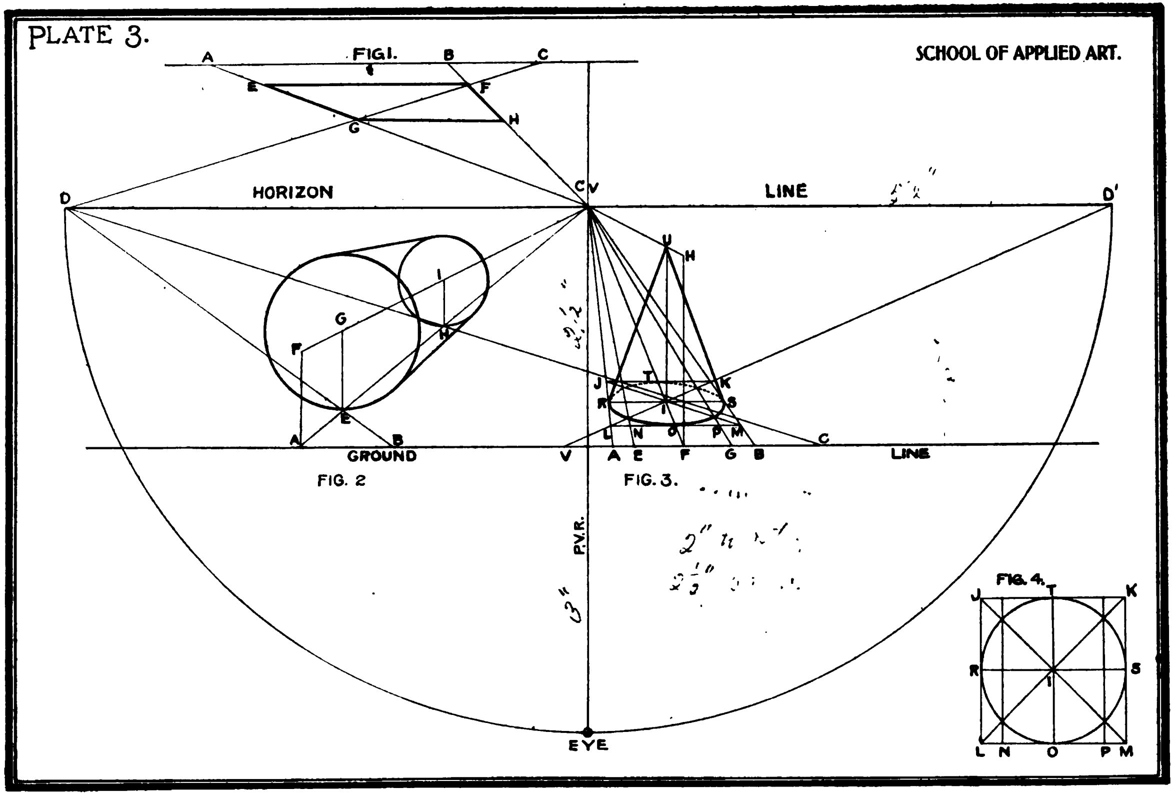
First draw a line 8′ high from Ground Line in the Picture Plane. This is done in this case by extending the P. V. R. Next make a line of indefinite length, at this height, parallel to Horizon Line. It is on this line the measurements are to be made. First find a point B. 3′ to left, and draw a line to C. V., then a point A. 5′ to left of B., and draw a line to C. V., these two lines form the side boundaries of the tile. It is 2′ back of Picture Plane, so a point on one of these lines has to be found 2′ behind the measuring line. Locate C. 2′ to right of B., from C. run a diagonal to D., and the point F. will be the nearest corner of the tile. Draw a line from F., parallel to measuring line, until it intersects the line A., C. V., and this will be the nearest side of the square. As stated in Instructions to Plate 1, a diagonal of a square running to D. or D′. is a measuring line for both corners, it follows then that where the line C. D. intersects A., C. V. at G. the further corner of the square is situated. Draw a line from G. parallel to the measuring line, andthe point H. where it intersects the line B., C. V. is the final corner of the square.

Fig. 2, is a cylinder 4′ in diameter, 9′ long, lying on the ground, with one end facing the Picture Plane, at a distance of 2′ behind it. The center or axis of the cylinder is 6′ to left of spectator.

First find the place on the Picture Plane where the axis will be. It is 6′ to the left, which, when marked off, gives A. If the ends are 4′ the axis will be 2′ above the ground. Draw a vertical line from A. and measure up 2′ locating F. From F. and A. run lines to C. V.; the line F., C. V., is the axis of the cylinder. The nearest face is 2′ back of Ground Line, so measuring 2′ from A, to the right, the point B. is found and a line is drawn from it to D. intersecting A., C. V., at E. The cylinder being 9′ long, measure 9′ to right of B. which gives C.; whence also draw a line to D. cutting A., C. V., at H. The distance E. to H. represents the length of the cylinder. At both E. and H. draw vertical lines until they touch F., C. V., at G. and I. Using these points as centres and G. E. and I. H. as radii, draw circles represent-

PLATE 3.

SCHOOL OF APPLIED ART.



ing the ends of cylinders. Connecting the outside points of each circle completes the figure.

Fig. 3. Place a cone in perspective. It is wholly to right of spectator, is 4′ high, has a 3′ base, and center of cone is 2′ to right and 2½′ back of Picture Plane. The circular base is flat on the Ground Plane.

The principal thing in this problem is to get the circular base properly into perspective, and the best way of doing this is to make a plan of it as shown in Fig. 4.

Draw a circle the required size, and draw a square around it; run diagonals to the corners of the square, and where the diagonals cut the circle, draw lines N. P. parallel to the sides of the square, then a line through the center, O. T., and a horizontal line R. S. Having made this diagram proceed to put it into perspective.

The center of the cone is 2′ to right of spectator, mark off 2′ on Ground Line locating F., and draw a line to C. V., and the line O. T. in Fig. 4 will coincide with line F., C. V. Having found a point from which to start work, measure off on the Ground Line the distances marked in Fig. 4, from L. to M. In Fig. 3, these points are represented by A. E. F. G. B. From each of the points draw a line to C. V., also draw the line R. S. through center. The center of the cone being 2½′ back of Picture Plane, mark 2½′ off on Ground Line to left of F. and draw to D′. Where this line intersects the line F., C. V., is the center of the cone. Likewise where it intersects A., C. V. and B., C. V. are the corners L. and K. of diagram. From K. run a line to A., C. V. parallel to Ground Line, and do the same from L. to B., C. V. Draw a diagonal from M. to J. and the diagram Fig. 4, is placed in perspective, the centre being 2′ to right of spectator and 2½′ back of Picture Plane. When this is done draw in the circle freehand, running it through the same points in the perspective drawing that it goes through in Fig. 4.

Everything is now ready to build the cone on the base thus obtained.

The apex of the cone will of course come over the centre of the base. It is 4′ high. As F. is the end of the vanishing parallel, for the centre I., construct a vertical at this point 4′ high to H. and draw a line from H. to C. V. Construct a vertical at centre I. and where it touches H., C. V., at U. is the apex of the cone. Join by straight lines to the points S. R. on the circumference of the base and the figure is complete.

INSTRUCTIONS FOR DRAWING PLATE 4.

The eye is 8′ above the ground and 11½′ in front of Picture Plane.

Place into perspective to left of spectator a hexagonal prism lying on the ground parallel to Picture Plane. The length of the prism is 7′, the sides of its ends being 2′, its nearest corner 2′ to left of spectator and 3′ back of Picture Plane.

First make a diagram of the hexagonal end of the prism. A hexagon is a six sided figure and is made by taking the required length of one of its sides, in this case 2′, as a radius and describing a circle. The radius of a circle will divide the circumference into six equal parts. Join these points with lines, thus forming the figure, as in Fig. 1. When this is done enclose the whole in a square. When putting into perspective the circle is not used.

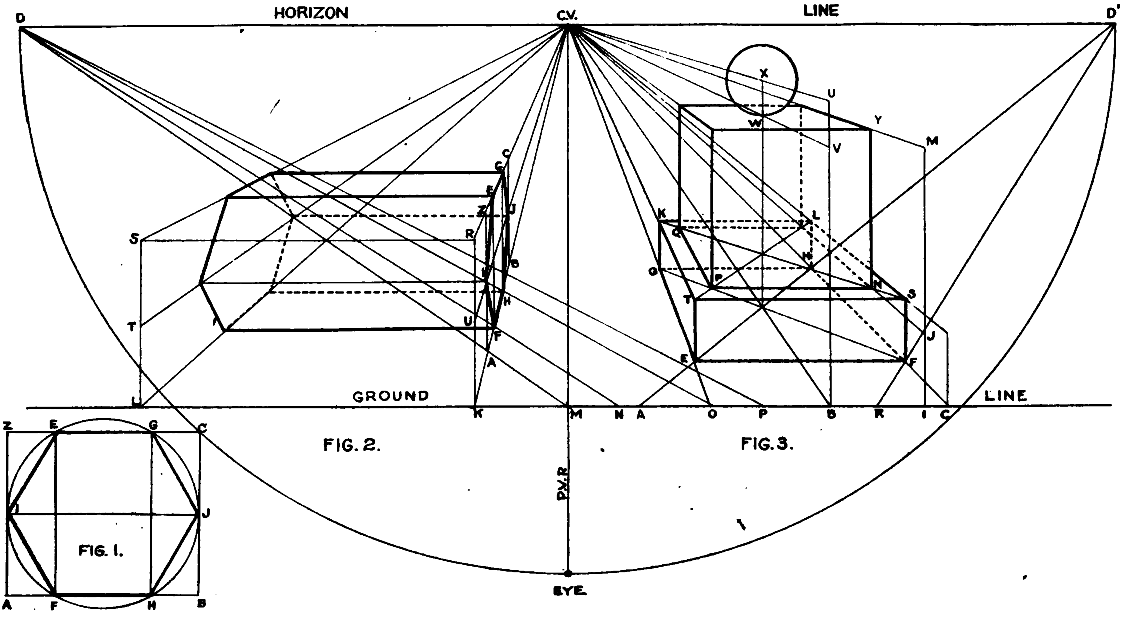
First find on Ground Line a point K. 2′ to the left of P. V. R. and draw a line to C. V., from K. draw a vertical the length of the line A. Z. in Fig. 1, which will give R. As the corner is 3′ back of Picture Plane, find a point N. 3′ to right of K. and draw line to D. It gives F. at the point of intersection with the line K., C. V., being one corner of the hexagonal end. From N. mark off on Ground Line the distances lettered on base of square Fig. 1, and draw lines to D. These lines will intersect the line K., C. V., at A. F. H. B., these being the various points shown in Fig. 1. From these points draw verticals to R., C. V. determining points Z. E. G. C. Next measure off on the vertical line K. R. Fig. 2, the distance A. I. in Fig 1 locating U. Fig. 2. From this point draw a line to C. V. Where this line intersects the verticals A. Z. and B. C. it locates the points I. J. Connect the various points of the diagram now in perspective and the hexagonal end is formed. Having drawn one end the rest is simple. The prism is 7′ long, so point off L. 7′ to left of K., construct a vertical line and on it mark off spaces T. and S. equal to U. and R. and draw lines from all these points to C. V. Next draw parallel lines from the corners of the hexagonal head already drawn until they intersect these lines, and join the various corners forming the prism.

Fig. 3 is somewhat more complicated than any previous problem, but not on that account more difficult.

A slab 5′ square and 1½′ thick lies to the right of spectator, its nearest corner being 3′ to right of P. V. R. and 1½′ back of Picture Plane. It rests

PLATE 4.

SCHOOL OF APPLIED ART.



REESE LIB
OF TH.
UN VERS
CALIF

on one of its large faces on the ground with one side parallel to Picture Plane. Resting in the centre of the slab is a 4′ cube, and on the center of upper surface of cube rests a sphere, 2′ in diameter.

First put into perspective a square, the ground plan of the slab, 3′ to the right and 1½′ back of the Picture Plane. Find the point O. 3′ to right and draw a line to C. V. Then locate the point A. and draw to D′., then measure 5′ to right from O. locating C. and draw a line to C. V., and 5′ from A. to R. and draw to D′.; this locates three corners of the square, E. F. H. Drawing a diagonal from F. to D. determines remaining corner G. Next draw a vertical at C. and measure off 1½′, the thickness of the slab, and draw to C. V.; erect verticals at F. and H. until they cut this line locating L. S. Erect verticals at E. and G. and draw horizontal lines from S. and L. until they intersect and slab is completed.

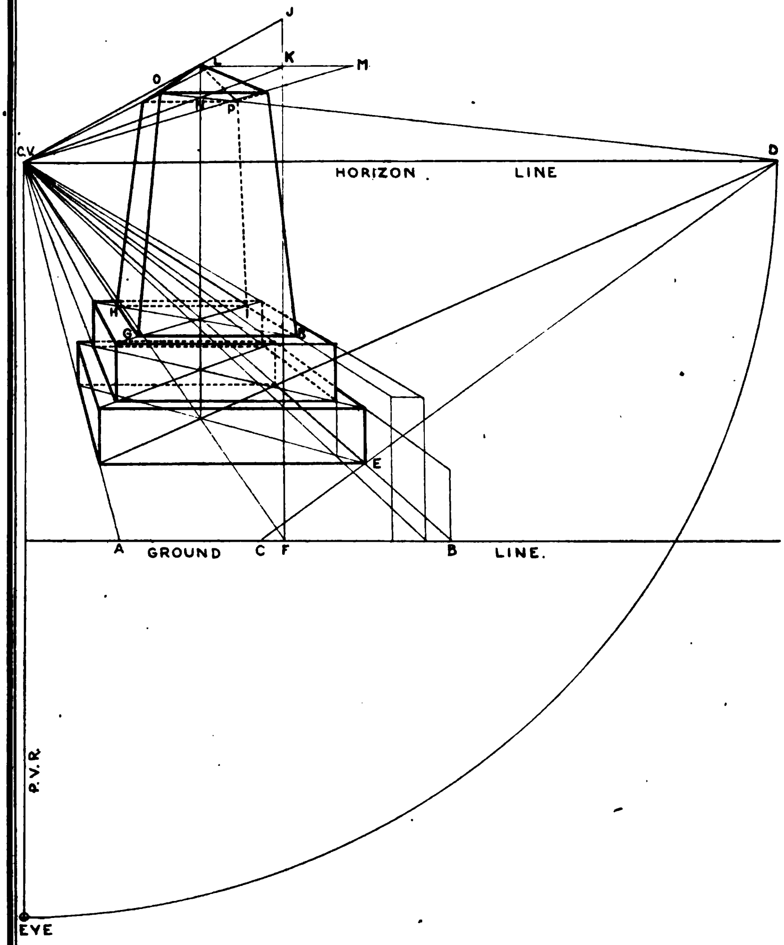
If the cube is to sit on the upper surface of slab and in its center, its corners will come on the diagonals of upper square of slab, so now put in lines S. K. and T. L. The slab being 5′ square and cube 4′ side there is 1′ to spare or ½ foot of space between the edges of slab and edges of cube. Mark point on Ground Line ½′ to left of C. and draw a vertical line 5½′ high, 1½′ for thickness of slab, 4′ for height of cube; measure these two points off on this vertical locating J., and draw lines to C. V.; where the line J., C. V., intersects the diagonal S. K. at N. will be one corner of the cube. Draw a line from N. to C. V. and another one horizontally to P., locating corners P. and L., a horizontal line from L. to Q. gives the remaining corner.

Then erect a vertical at N. until it cuts line M., C. V., and one corner of top of cube is found. To find remaining corners and finish the top of cube, proceed as instructed in the case of the slab.

We have now to draw the sphere. As a sphere, no matter from what point of view it is seen is always a perfect circle, we have only to find its radius in perspective at the centre of cube. The diameter is 2′ so the radius is 1′. The center of slab is already established by the crossing of its diagonals F. G. and E. H. From C. V. draw a line through this centre to Ground Line at B. Erect a vertical 6½′ high to U., 1′ for radius of sphere, 4′ for cube and 1½′ for slab; mark off the 1′ radius on this line at V. and draw lines to C. V. Next erect a vertical at centre of slab and where it intersects these lines at W. X. is the radius required. Taking X. as a centre, describe a circle. which forms the sphere.

PLATE 5.

SCHOOL OF APPLIED ART.



REESE LIBRARY
OF
UNI
OF

INSTRUCTIONS FOR DRAWING PLATE 5.

In this plate, for sake of making things plainer to student, we have shown but one half of the regular plate, as it enables us to use a larger scale.

The eye is 16′ in front of Picture Plane and 8′ above the ground.

A slab 7′ feet square, 1½′ thick, rests on the ground parallel to Picture Plane, being on the right of spectator. Its nearest corner is 2′ to right and 4′ back of Picture Plane. On the centre of the slab rests another 6′ square 1½′ thick. On centre of upper slab rests the base of a monument which is 4½′ square. The monolith is 8′ high and tapers to 3′ square at 7′ from its base; the sides from this height running to a point.

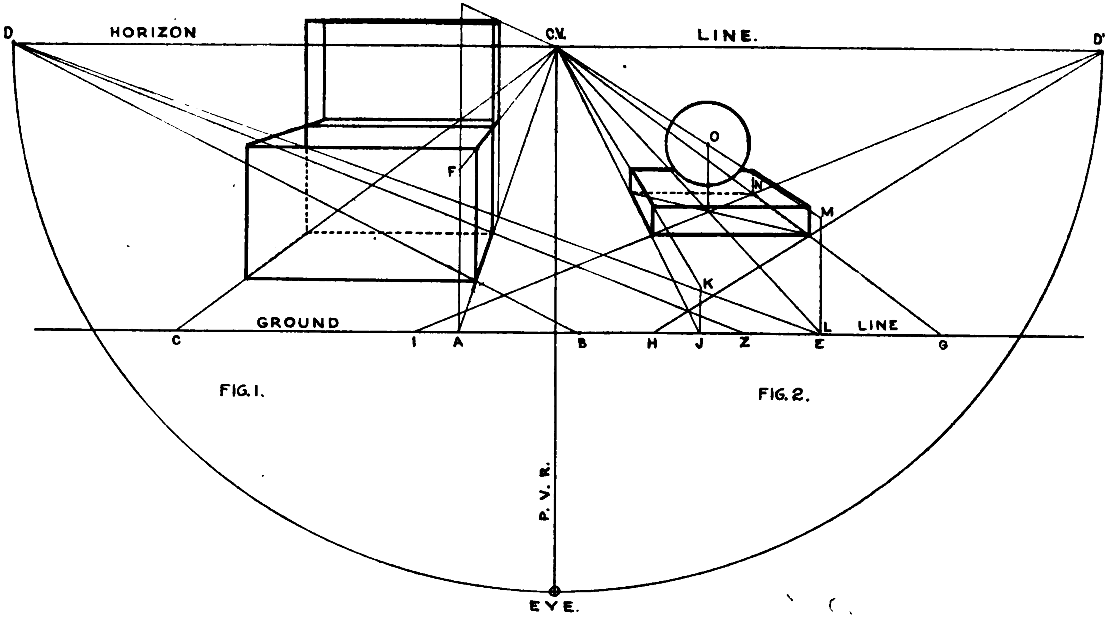
Mark off first A 2′ to right on Ground Line, and draw a line to C. V.; then from A., 7′ for length of slab to B. and draw a line to C. V. From B. mark off 4′ to C. and draw line to D., locating E. one corner of slab. From explanations to previous plates the student should now be able to construct the two slabs and the above base of the monolith, R. G. H. I. This being done construct a 3′ square 7′ above this base, whose centre shall coincide with the centres of the slabs.

Drawing a line from C. V. through the points of intersection of diagonals of lower slab to F.. at this point, erect a vertical line J. F. 11′ high. One foot from J. on this line, mark off K. and draw a line from both points to C. V. Erect a vertical line from centre of slab, and where it intersects lines K., C. V., and J., C. V., will be the centre of the upper square and the apex of monolith.

At K. make a horizontal line for the same purpose as described in Fig. 1, Plate 3, 3′ long, locating L. M., and draw lines from these points to C. V. Then a line from D. through centre of square N. This diagonal will locate the two corners O. and P. Finish the square, run lines from the corners of upper square to corners of lower one, and from corners of upper square to the apex of the monolith, and the figure is complete.

PLATE 6.

SCHOOL OF APPLIED ART.



REESE LIBRARY
OF THE
UNIVERSITY
OF CALIFORNIA

INSTRUCTIONS FOR PLATE 6.

In this plate the previous problems are reversed. The two Figs. in the text are to be put into perspective and their relative dimensions found.

Distance of eye in front of Picture Plane 11½′. Height of eye above Ground Plane 6′.

Fig. 1, is a box with an open lid. It sits on the Ground Plane with its nearest corner 2′ to left and 2½′ back of Picture Plane. The front is parallel with the Picture Plane.

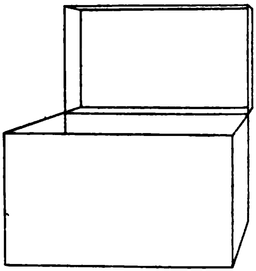


FIG. 1.

Required the length of the front of box, the height of front of box, the thickness of box and the depth of the lid.

First prepare the paper as instructed in previous plates, then find 2′ to left at A. and draw to C. V., then 2½′ back of Picture Plane at B. and draw to D′. This will be the corner required; with this point found, construct the box as per diagram. When drawn in, run a line from C. V. through left front corner to C., giving length of front on Ground Line 6′. Then draw a line from D. through back corner to Z., from B. to Z. is the thickness 2½′. Continue back of lid downward with a line until it intersects A., C. V., and at point of intersection run a line through from D. to E. which when measured gives depth of lid 1½′. At A then erect a vertical and run a line along upper side of box from C. V. to F. establishing height as 3½′.

Dimensions,

Length of Front . . .	6′
Height of Front . . .	3½′
Thickness of Box . . .	2½′
Depth of Lid	1½′

Fig. 2, is a sphere sitting on centre of a slab, The slab rests on the Ground Plane, one of its sides parallel to Picture Plane. Its farthest front corner is 8′ to the right and 6′ back of Picture Plane.

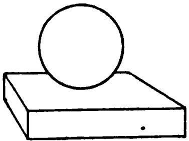


FIG. 2.

Required the size of slab, thickness of slab, and diameter of sphere.

First mark off 8′ to right locating G., and connect with C. V.; then 6′ to left locating H. and draw a line to D′. On this furthest corner erect the figure.

Draw a line through nearest corner from C. V. to J., giving length of front 5′, Then draw a line from D. through back corner N. to I. As this line passes through the nearest corner and makes a diagonal, the slab is square. From J. erect a vertical and draw a line from C. V. through upper left hand corner to K. K. J. measures 1′, the thickness of slab.

Then drawing another diagonal on ground plan, draw a line from C. V. through center to Ground Line at L. Erect a vertical and draw a line from C. V. through O., centre of sphere, to M.; L. M. will be the height of centre of sphere above ground, 2½′, as slab is 1′ the radius of sphere is 2½ less 1 = 1½′ radius, the diameter being twice this, gives 3′.

Dimensions,

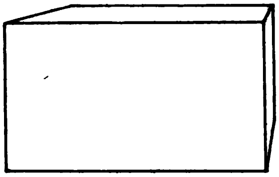
Slab . . .	5′ square, 1′ thick
Sphere . .	3′ diameter.

PROBLEMS TO BE WORKED OUT.

These problems should be drawn on paper 11 x 14 inches. The scale is to be ½ inch to the foot, unless otherwise stated. Draw only one problem on a sheet, and for lines describing the back sides of figures use dotted lines in a similar manner to instruction plates. Problems 3 and 5 are to be worked out on the same plan as exercises in Plate 6 of instructions.

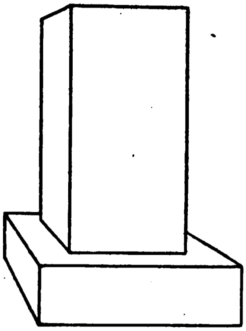
1. A triangular prism 7′ long sits on the ground. Its nearest corner 1′ to the left of spectator, and 5′ back of the P. P., its ground plan is 7′ by 6′ and one 7′ edge is parallel to Ground Line. Its apex is 6′ high. The eye is 5½′ above ground and 12′ in front of P. P.

2. A slab 7′ square and 1½′ thick rests on the ground, to the right of spectator. One side is parallel to P. P. its nearest corner 2′ to right, and 3′ back of P. P. A cylinder 3′ in diameter and 7′ high rests on its end on the center of slab. The eye is 5½′ above the ground and 12′ in front of P. P.



3. This diagram is to be enlarged to twice its present size. The bottom right hand corner is 1′ to left of spectator and 3′ back of P. P. Its bottom edge is parallel to the ground line. Determine the actual size of the block. The eye is 11½′ in front of P. P. and 6′ above the ground.

4. A rectangular prism 4′ square and 9′ long lies on the ground with one of its long faces parallel to P. P. One corner is 1′ to right of P. V. R. and another 8′ to left. Exactly in center of front face a round hole 2′ in diameter is bored completely through the prism. The eye is 7′ above G. L. and 12′ in front of P. P.



5. This diagram is to be enlarged to twice its present size, the bottom left hand corner of the base is 3′ to right of spectator, and 2′ back of P. P. Its bottom edge is parallel to ground line. Determine the actual measurements of the figure. The eye is 6′ above the ground, and 11½′ in front of P. P.

6. Scale this drawing ¼″ to 1′. Situated to left of spectator is a small barn, the ground plan of which is 14′x 19′. One of its 14′ sides faces the spectator. Its nearest corner is 6′ to left, and 3′ back of P. P. Its front is 14′ wide by 11′ high to the eaves. The ridge of the roof is parallel to horizon line and is 5′ higher than eaves, and 9½′ back of front. A door is situated in front, 8′ high by 4′ wide, its nearest side is 8′ to left of nearest corner of barn. 12′ to right of barn is situated a round water tank, 10′ in diameter and 7′ high. Its center is 18′ back of P. P. and 11 to right of P. V. R. The spectator is 24′ in front of P. P. and his eye is 10′ above the ground.

Angular
Perspective.

MATERIALS.

The instruments required in angular perspective will be the same as those used in direct perspective, except that a protractor, which is used for measuring angles, will be needed. We will furnish these, either of horn or brass, for 15 cents, postpaid, or of German silver for 55 cents postpaid. It is so simple an instrument that no instruction in its use is necessary. Every circle contains 360 degrees. The protractor, which is semi-circular, is divided and marked off into 180 degrees.

ESE LIBRARY OF THE UNIVERSITY

GENERAL INSTRUCTIONS.

In the preceding paper on Perspective, the objects represented have all been parallel or perpendicular to the Picture Plane. This is the simplest form of the study. In the present paper Angular Perspective will be treated, which, combined with the first paper, will give the student a thorough grounding in, and a first-class working knowledge of, the subject.

Do not slight any knowledge of this study, no matter how simple or unnecessary it seems. A thorough training in perspective is a matter of paramount importance to any artist, and once learned, the principles are so useful and the necessity for the use of them, is of such daily occurrence in his work, that it is not making too large a claim to say they are never forgotten.

In theoretical perspective, studied by means of diagrams, which is the only satisfactory method of learning it, there is one fact that must be continually kept in mind, that is :

Every vanishing line has its own measuring point.

In connection with this statement is another :

This measuring point is the eye. All parallel vanishing lines vanish to the same point, and practically for measuring purposes are one ; that is, they use the same vanishing and measuring points as each other.

The explanation of these statements is given in Fig. 13 and Fig. 14 below.

We now abrogate the statement made in Definitions and Abbreviations, page 4, Part 1, that C. V. is the only vanishing point, and D. and D′. the only measuring points. In Angular Perspective we find a separate vanishing and measuring point for each vanishing line that is not perpendicular to the P. P. or parallel to some other line. This is the principal difference between Angular and Direct or Parallel Perspective.

The diagram Fig. 13 is practically a replica of Fig. 7, with some added details.

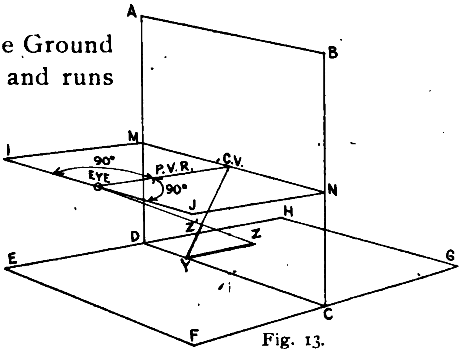


Fig. 13.

A line Y. Z. lies on the Ground Plane to left of spectator and runs directly away from him, its near extremity touching the P. P. at Y.

This diagram and the next, as stated above, are for the purpose of demonstrating the truth of the axiom previously laid down, "The eye is the measuring point of all vanishing lines."

Since the line Y. Z. runs directy away from the spectator, or in other words, is perpendicular to the Picture Plane, it must vanish to the C. V., which gives it, necessarily, an angle of 90° with the Directing Line, or the line on which the spectator stands. Having connected Y. with C. V., we measure its length on the Picture Plane by a line or a ray of light representing its farther end, from Z to the eye. This line cuts the line Y., C. V. at Z.^{1} Consequently Y. Z.^{1} represents the position and length of Y. Z. as seen on the P. P.

But as stated in Part 1, as we have no means of attaching a piece of paper to stand at right angles with the paper upon which the problem is drawn, we must measure our line in some different manner. Hence we revolve the eye into the P. P., bringing it to D. on the Horizon Line, as shown in Fig. 14. This necessitates revolving the line we wish to measure into the P. P. likewise, but to keep its relative distance from the eye the same, we revolve it in the

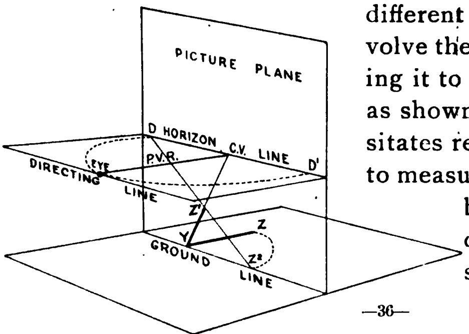


Fig. 14.

contrary direction. This is done by bringing Z. to Z.^{2} on the Ground Line. Running a line from Y. to C. V., the same as in Fig. 13, a measuring line is drawn from Z.^{2} to D. intersecting Y., C. V. at Z.^{1} and getting exactly the same results as obtained in Fig. 13. The line Z.^{2} D. being the same as Z.^{2}, the Eye in Fig. 13. Z. might have been revolved in the contrary direction, bringing it into the Ground Line on the farther side of Y., in which case D.^{1} would be the measuring point. The resulting point Z.^{1} would come to the same place in either case.

By referring to Fig. 13 it will be seen that the line Z. eye is partly in front and partly behind the P. P., the point where it strikes the P. P. being Z.^{1} Taking Z.^{1} as a pivot we revolve the whole line into the P. P. It will thus be seen that there is no change of any kind in the relative distance between Z. and the eye. This could also be proved by trigonometrical calculations, but the fact is so evident it is not necessary.

There is no contradiction between what is here stated and what was stated in Part 1. The present explanation is but an amplification of previous statements.

The foregoing explanation is for a case of direct perspective, as the line vanishes at 90° from the eye. But exactly the same principle applies to angular perspective. It is, however, as stated before, necessary to find the vanishing point. In direct perspective there is no trouble finding the vanishing point, as C. V. answers for all lines running directly away from us, and that point is a necessity in any case. In angular perspective C. V. will not always answer, and it is necessary to find another, as explained in Fig. 15 and Fig. 16.

In Fig. 15 and Fig. 16 the planes are identical with those of Fig. 13 and Fig. 14. A line Y. Z. lies on the Grond Plane to left of spectator, and runs away

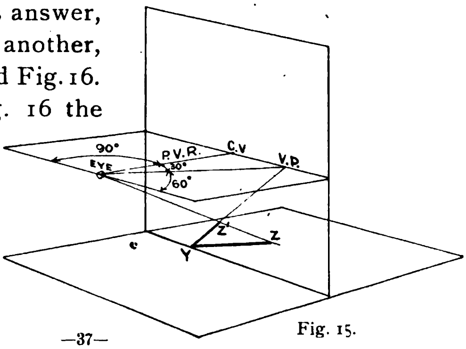


Fig. 15.

from him at an angle of 60° to the right, its near extremity touching the P. P. at Y. As the line vanishes at 60° instead of 90°, C. V. cannot be used as a vanishing point, so taking a protractor, 60° is marked off from the Directing Line, and through the point thus obtained a line is run from the eye to the Horizon Line at V. P. This being the point to which Y. Z. vanishes, a line is drawn connecting Y. with V. P., as shown in Fig. 15. From the farther extremity Z of line Y. Z. a line is then run to the eye, and the point Z.^{1} where it intersects the line Y., V. P. establishes the end of line Y. Z. when that line is placed into perspective.

Fig. 16 is but a repetition of Fig. 14. The V. P. is found as stated above, the eye is then swung into the P. P. to M. P. and the end Z. is brought forward into the P. P. at Z.^{2}; a line connecting M. P. and Z.^{2} is then drawn, and where this line intersects Y., V. P. is the point Z.^{1} It will be seen that this operation gives the same result as that in Fig. 15.

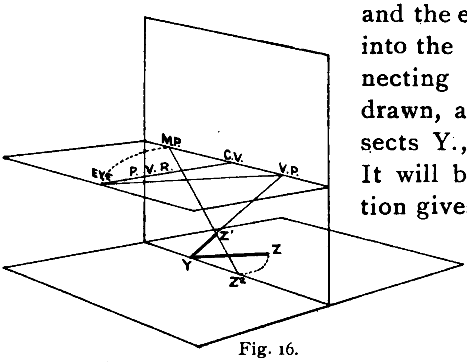


Fig. 16.

When finding the measuring point for C. V. in Direct Perspective, the point of the compass is placed in C. V. and a semi-circle is drawn, with C. V. eye as a radius. In this present case (see Fig. 17) V. P. eye is taken as a radius, to find the M. P. for 60°. The semi-circle is not completed, as only one M. P. is needed. If two M. P.'s were necessary, the semi-circle would be brought com-

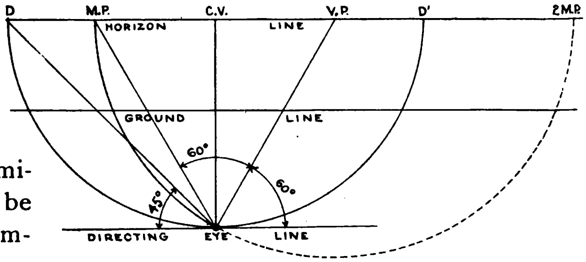


Fig. 17.

pletely around to 2 M. P., but all necessary measurements may be made from one M. P., hence in working a problem only the portion of the semi-circle between the eye and M. P. shown as a solid line is drawn; the remainder is left out. Plate 5 while a solution in Direct Perspective, is worked with only one Measuring Point.

In Direct Perspective, where a square, whose sides vanish to C. V., is placed in perspective, it is only necessary to find one corner, the diagonals of the square running to D. and D.^{1}, the measuring points of C. V., giving the remaining corners. It may seem to the student that a square, put into perspective, say at an angle of 60° and vanishing to V. P. in Fig. 17, should have its diagonals run to M. P. This, however, is not so, and a study of that diagram will show the reason why.

In Direct Perspective, a square whose sides run to C. V. uses the P. V. R. as a vanishing parallel. Now the measuring point and 45° angle of that parallel coincide at D. or D.^{1}, that is, the eye, being revolved into the picture plane, strikes the horizon on the point of an angle of 45° with the P. V. R., consequently, as shown and proved in direct perspective, all lines running at an angle of 45° with the side of the square, or P. V. R., will come into the horizon at D. or D.^{1}, the measuring point of C. V.

Taking Fig. 17 and the vanishing parallel of 60° as an example, we see the reason why the same method of using the diagonal as a measuring point will not apply in angular perspective. Placing the foot of the compass, as previously explained, into V. P. and taking that point and the eye as a radius, we revolve the eye into the Picture Plane, at M. P., which is the point at which the eye will touch the horizon. A straight line drawn from the eye to this point will not make an angle of 45° with the vanishing parallel, Eye V. P.; it, in fact, makes an angle of 60°. Thus it is very evident that a diagonal of a square, which vanishes at an angle of 45° with the vanishing parallel, cannot be drawn to this point.

INSTRUCTIONS FOR DRAWING PLATE 7.

The spectator is 12′ in front of P. P. and his eye is 5′ above the G. L.

Place in perspective a 6′ square, it lies on the G. P., its nearest corner is 1′ to left and 3′ back of P. P., its left side vanishes at 50° to left.

A rectangular plane 7′ high by 4′ wide stands vertically on the square on one 4′ edge, its nearest corner is 3′ to right of nearest corner of square, and 1′ back of right side of square, it vanishes to left at an angle of 65°.

First find nearest corner ot square, by marking off point 1, one foot to left of P. V. R. and running a line to C. V., then 3′ to right of point 1 and running to D., this gives Z. the nearest corner of the square. The left side vanishes at 50° to left, mark this angle off with a protractor on Directing Line, and run a straight line from Eye to Horizon Line, obtaining the Vanishing Point for 50°, placing the leg of the compass at this point and with the eye as a radius, describe an arc to H. L., cutting it at M. P., 50°. This is the Measuring point of all lines vanishing at V. P. 50°.

Having now the V. P. and M. P. for two sides of the square, run a line from M. P. 50° through Z. to G. L., finding A., measure off 6′ to left at B. and run from B. to M. P. 50°. Next draw a line from Z. to V. P. 50°, where this line cuts the last one at W. is the second corner, W. Z. forming one side.

A square being a rectangle, its corners will be angles of 90°, so measure off with protractor 90°, to right of the 50° mark obtained before from Directing Line, and run a line at this angle to H. L. at V. P. 40°, with this point and eye as a radius, describe an arc to H. L., obtaining M. P. 40°, the Vanishing and Measuring Points of the other two sides of square.

Draw lines from Z. and W. to V. P. 40° and somewhere on these lines are the sides required. Through Z. draw a line from M. P. 40° to G. L. at C. and measure off on G. L. 6′ to right at D., from D. draw a line to M. P. 40° establishing Y. the third corner. From Y. draw to V. P. 50° cutting W., V. P. 40° at X. and square is complete.

The nearest corner of rectangle is 3′ up right side of square and 1′ back. Measure 3′ from C. on G. L. to E. and run a line to M. P. 40°, from point of intersection of this line with Z. Y., at K. draw a line to V. P. 50°, 1′ back on this line is the corner required.

From A on G. L. measure 1′ to left at F and draw a line to M. P. 50°, from point where this line cuts W. Z.; at L draw a line to V. P. 40°. Where L., V. P. 40° and K., V. P. 50° intersect at V. is the corner required.

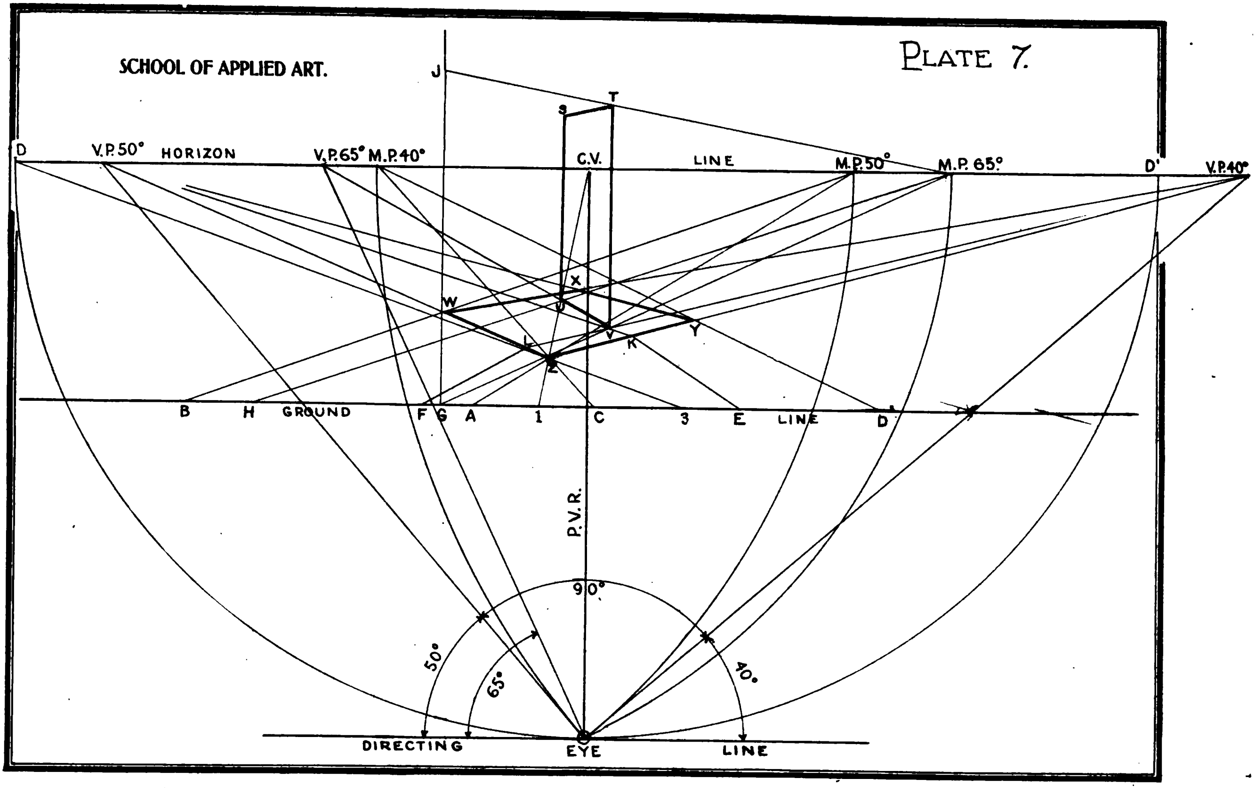
As lower edge of plane vanishes at 65° to left, obtain V. P. 65° and M. P. 65° as former vanishing and measuring points were obtained.

From M. P. 65° draw a line through V. to G. L. at G. and as the side required is 4′ long measure 4′ to the left at H. and draw a line to M. P. 65°. Next draw a line from V. to V. P. 65° and at point of intersection with last line at U. is the second corner.

The plane is 7′ high, so erect a perpendicular on Ground Line at G. and finding 7′ at J. run a line from this point to M. P. 65°, erect a perpendicular at V. until it cuts this line at T. the third corner, run a line from T. to V. P. 65° and erect a perpendicular at U. where these two lines intersect at S. is the last corner.

SCHOOL OF APPLIED ART.

PLATE 7.



INSTRUCTIONS FOR DRAWING PLATE 8.

Fig. 1 is the front elevation of a window.

The spectator is 11′ in front of P. P. and 6′ above G. L. The corner Z. is 1¾′ to right and ¾′ back of P. P. The line Y. Z. rests on the G. P. and vanishes to left at an angle of 30°.

Mark off the Vanishing Parallel of 30° to left and also the M. P. for same. Next locate the corner Z. From V. P. 30° draw a line through Z. to G. L. at A., erect here the perpendicular line A. B. From M. P. 30° draw a line through Z. to G. L. at C. next lay off on G. L. the various distances A. to D. and run lines to M. P. 30°. Where these lines cut the line A., V. P. 30° are the terminals of the lines on the base of Fig. 1; at these points erect perpendiculars. Along the line A. B. in the perspective drawing mark off the various spaces on A. B. Fig. 1, and from these points draw lines to V. P. 30°. Where these lines intersect the verticals erected on base line are the salient points of the window.

With these points located the perspective drawing can easily be finished.

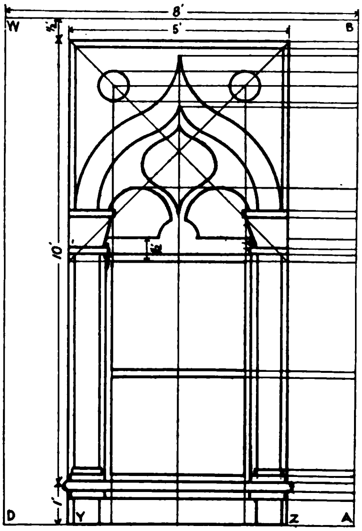


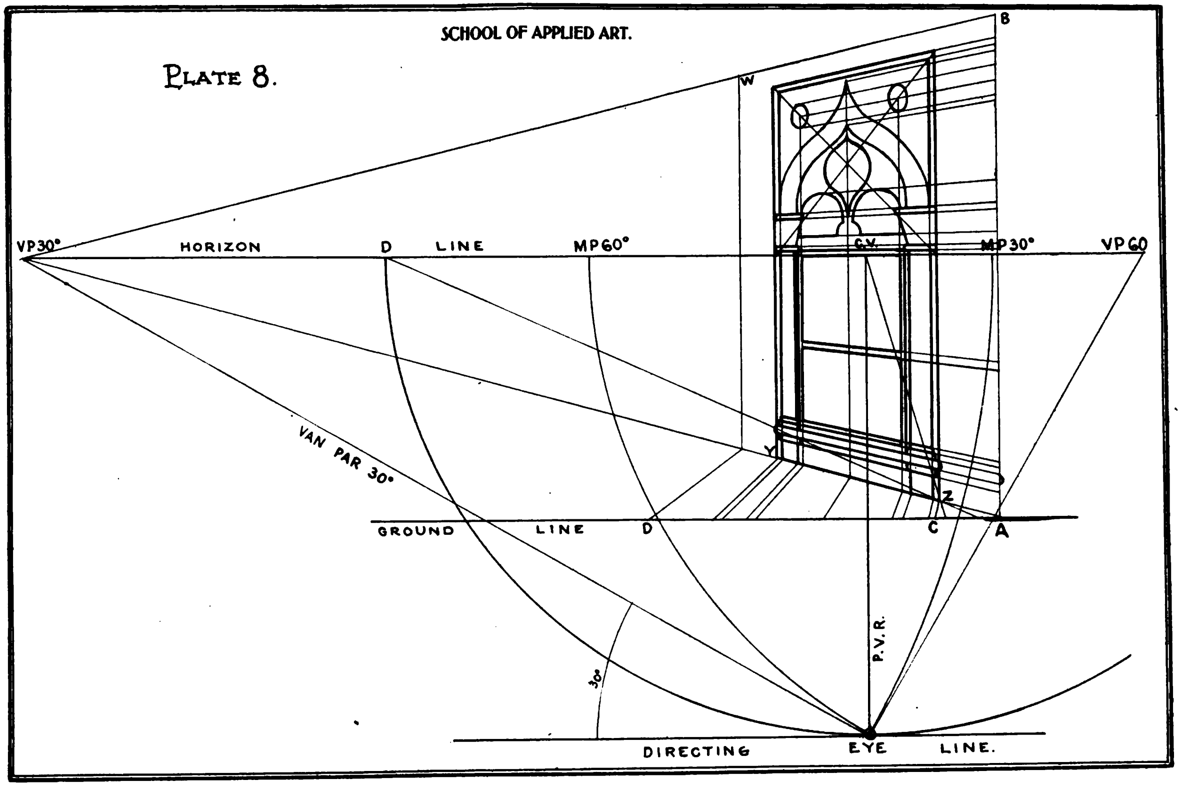
Fig. 1.

It will be noticed that no thickness is shown in this problem, but there is really no necessity for it; the side elevation could have been placed in perspective just as easily as the front one, and it could be superimposed upon this drawing by taking the V. P. 60° and M. P. 60° as the Vanishing and Measuring Points for it, but the projection would be so slight that it would be a waste of time making a perspective representation of it. It should be an easy matter to draw in freehand.

Thicknesses will be fully treated in following plates.

SCHOOL OF APPLIED ART.

PLATE 8.



INSTRUCTIONS FOR DRAWING PLATE 9.

Figs. 1, 2 and 3 below are respectively the end elevation, side elevation and ground plan of a trunk, all necessary dimensions being marked thereon.

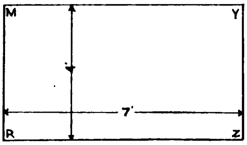


Fig. 1.

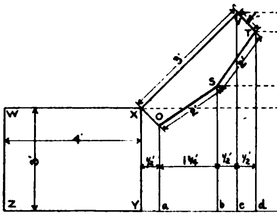


Fig. 2.

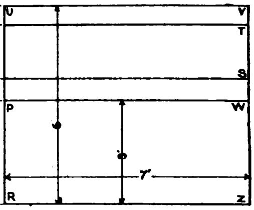


Fig. 3.

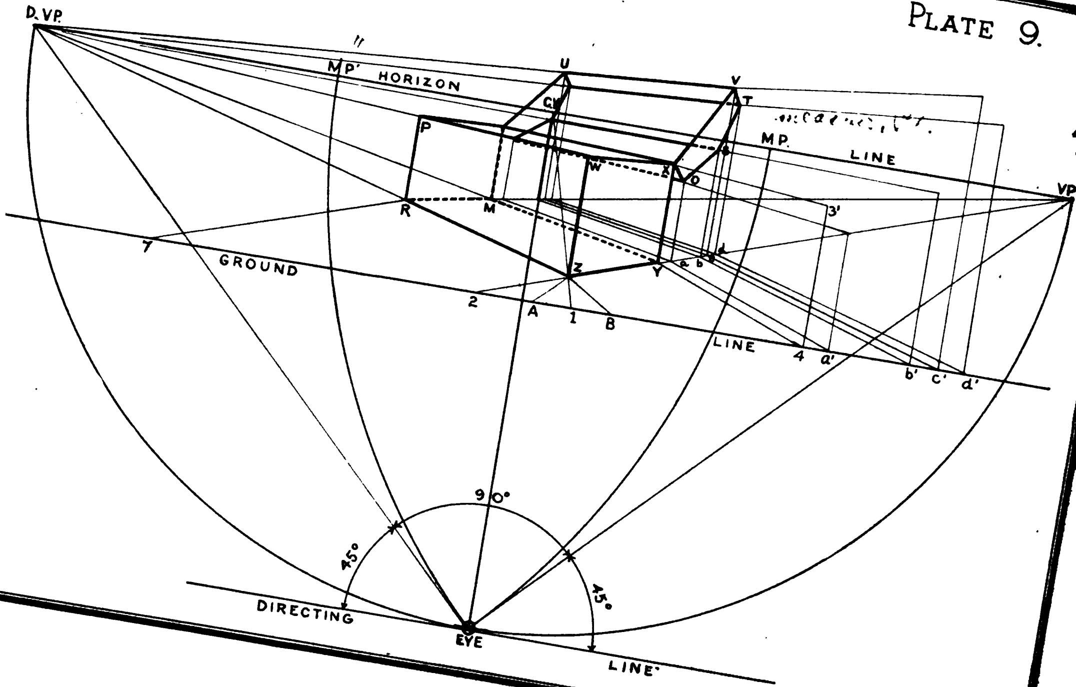
Its nearest corner Z. is 1′ to right of spectator and 2′ back of P. P.; its side Z. R. runs at an angle of 45° to left. Place into perspective. The spectator is 11′ in front of P. P. and 4′ above G. L.

First locate Z. As D. and D¹ are the vanishing points for 45° and as angles of the ground plan are right angles, or angles of 90°, Z. R. and Y. M. will vanish to the distant point on the left, D., and Z. Y. and R. M. to that on the right, D¹. Find M. P. and M. P¹.

From Z. draw a line to D, and from M. P. run a line through Z. to A. Measure off the distance Z. R., Fig. 3 on G. L. to 7, and draw to M. P. locating R. From R. and Z. draw to D 1. Measure off on G. L., Z. Y. Fig. 1 at 4, and draw to M. P1 locating Y., from Y. run to D. and complete ground plan by finding M. Mark off to right of 4 on G. L. the distances a, b, c, d, Fig. 1, and run to M. P 1; where these lines cut the line Z., D 1, erect perpendiculars. At a1 b1 c1 d1 on G. L. erect perpendiculars and mark off the various dimensions of the lines in Fig. 1 upon them. From each of these points draw a line to M. P 1, and where they intersect the perpendiculars a, b, c, d, will be the points O., S., T., V., also erect a perpendicular at 4 on G. L. to 3′, and Y. at perspective drawing, draw from 3′ to M. P. finding X. Erect a perpendicular at Z. and draw from D1 through X. to W.; from W., X., O., S., T. and V. draw lines to D.

The method of obtaining the farther end of the trunk is exactly similar, simply erect vertical lines until they intersect those last drawn in.

PLATE 9.


D.VP.
MP'
HORIZON
U
V
T
C
P
MP.
LINE
X
W
O
VP'
D'
R
M
3'
7
GROUND
Z
Y
a
b
d
2
A
1
B
LINE
4
a'
b'
c'
d'
90°
45°
45°
DIRECTING
EYE
LINE

INSTRUCTIONS FOR DRAWING PLATE 10.

In this Plate the spectator is 11' in front of P. P. and his eye is 5' above G. L.

Fig. 1 is an equilateral triangle of 4' sides, which lies flat on the ground, its side R. T. vanishes at an angle of 80° to the left, R. being the nearest point and T. being 1' to left of P. V. R. and 7' back of P. P. The side R. S. vanishes at 40° to right. This triangle is the base of a pyramid 6¼' high. Place into perspective.

Fig. 2 is the end elevation of a regular pentagonal prism, its ground plan is a rectangle 10' long by 3' wide, its face vanishes at 50° to left, its long side at 40° to right. Its nearest corner W. is 4½' to left and 5' back of P. P. It rests on the ground.

For placing the triangle Fig. 1 into perspective, first mark off point 1 which is 1' to left, and run to C. V. then 7 and run a line to D. locating T. one corner of triangle. Find V. P. for 80° and then M. P. 80°; also V. P. 40° and M. P. 40°.

Run a line from V. P. 80 through T. to G. L. at H. and a line from M. P. 80 through T. to G. L. at C. From C. mark off on G. L., K. E., equal to M., R., in Fig. 1. From these points draw lines to M. P. 80 locating one side of triangle T., M., R.

Next run a line from R. to V. P. 40 and a line from M. P. 40 through R. to G. L. at F.; measure off to right of F., J. G. equal to L. S. Fig. 1, and run back to M. P. 40, locating L. S. second side of triangle. Connect T. S. and the triangle is formed. Then to locate center draw dotted lines M. S. and L. T. From V. P. 80 draw a line through center to G. L. at O., erect there a perpendicular, mark off 6¼', height of pyramid, and run back to V. P. 80, erect a perpendicular at center and where the two lines intersect is the apex of pyramid. Connect apex with corners and figure is complete.

In finding the height we have run a line through center from V. P. 80 to G. L. and back again. It makes no difference what point on the H. L. we take for our starting point, if we run back to it again. Thus we might run from D. through center to G. L. erect a perpendicular, mark 6¼' and run back to D, the result would be the same.

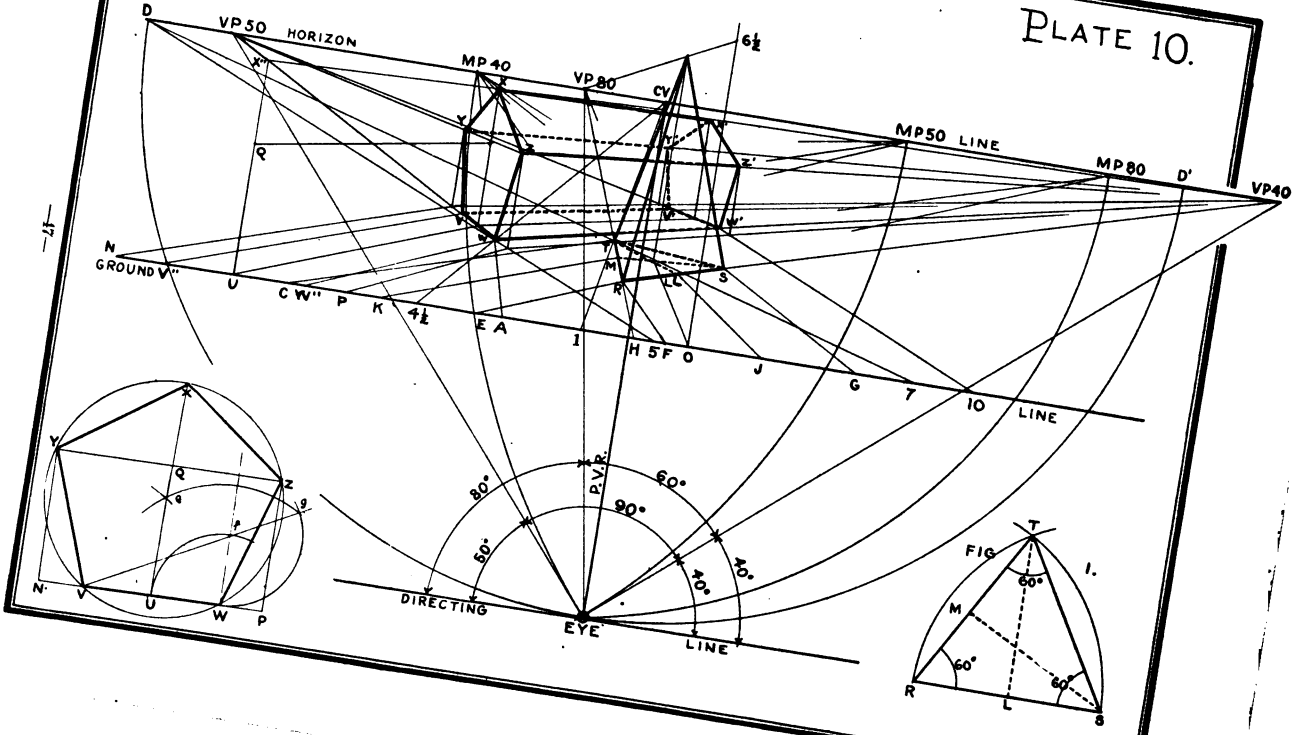
To construct an equilateral triangle, mark off on a straight line the required length of side R. S. in this case 4', set the leg of the compass in R. and draw an arc, with R. S. as radius, then set compass in S. and draw another arc; where the two arcs intersect is the other corner.

Fig. 2 is a pentagon and is the end of a pentagonal prism 10' long. The corner W. is 4½' to left and 5' back of P. P. As its face vanishes at 50° to left and its long face at 40° to right, find the respective vanishing and measuring points and draw a line to each V. P. from W. Draw a line from M. P. 50 through W. to G. L. at W." and with this as a base mark of the dimensions of the base of pentagon on G. L., P. W." U. V." and N. Run lines from each of these points to M. P. 50 until they cut the line W., V. P. 50. Erect the perpendicular for center and sides. Next erect a perpendicular on G. L. at U. and mark off the spaces Q. and X." equal to Q. and X. on Fig. 2, and run lines from these points to M. P. 50 and at point where the line from Q. cuts the center perpendicular, in the perspective representation, draw a line through to V. P. 50 obtaining Y. Z.; this finishes the pentagonal face by joining the corners. From each corner draw a line to V. P. 40, the other pentagonal face is easily obtained by erecting perpendiculars in the same manner as was done for the first one.

To construct a regular pentagon, where one side is given, mark off on a line the required length, in this case V. W., and erect a perpendicular at W.; take half the length of V. W. and mark off on perpendicular at f, from V. draw a line through f, and mark off on this line g, equal to f, W. With W. g as a radius, construct an arc inwardly; next put leg of compass in V. and with same radius draw another arc. Where these two arcs intersect at e is the center of a circle, running through V. and W. Mark off on circle the other three points, X. Y. Z., and connect with lines.

SCHOOL OF APPLIED ART.

PLATE 10.



INSTRUCTIONS FOR DRAWING PLATE 11.

While this exercise will be essential to the majority of students, yet there are some who do not need it. It need not be studied by such, but may be taken up later if found desirable. There are no dimensions given, because pump is placed into perspective same size as drawing.

The spectator is 11' in front of the P. P. and 4' above the G. L. The corner Z. is 1' to right of spectator and 2' back of P. P. The front elevation Z. Y. vanishes to left at 30°, the small side elevation to right at 60°,

There would be no need to put so many details in a perspective drawing as we have done; they have been drawn in only to show method of working.

Find the respective vanishing and measuring points and the position of Z., and from Z. draw a line to V. P. 30; then from M. P. 30 draw a line through Z. to G. L. at A. and measure off to left on G. L. the various distances shown on base of front elevation between Z. and Y.; draw lines from all these points to M. P. 30 until they intersect the line drawn from Z. to V. P. 30. These will give the locations of most points on the front elevation, projected to the ground.

Draw a line from M. P. 60 through Z. to G. L. at B. and from B. mark off to right on ground line the various points shown in small side elevation. Where the line through W. touches G. L. at C. erect a perpendicular, and on this perpendicular make all vertical measurements.

As the end of the steam cylinder overhangs the base, it will be necessary to carry it out farther, as has been done in the line E. F.; erect a vertical line at W. and from the points already obtained on vertical line at C. run lines to M. P. 60 until they cut the perpendicular at W.; erect verticals at E. and F. and draw through points, obtained on line at W., to V. P. 60 until they cut the last mentioned verticals (E. and F.); this will give the square containing the circular end of cylinder. Draw in diagonals and end.

The portion of the circle seen at other end of steam cylinder is drawn in the same way, except there is no need of a square; only one-half shows, and by erecting verticals at proper places until they intersect the vanishing parallels, the curve can readily be drawn.

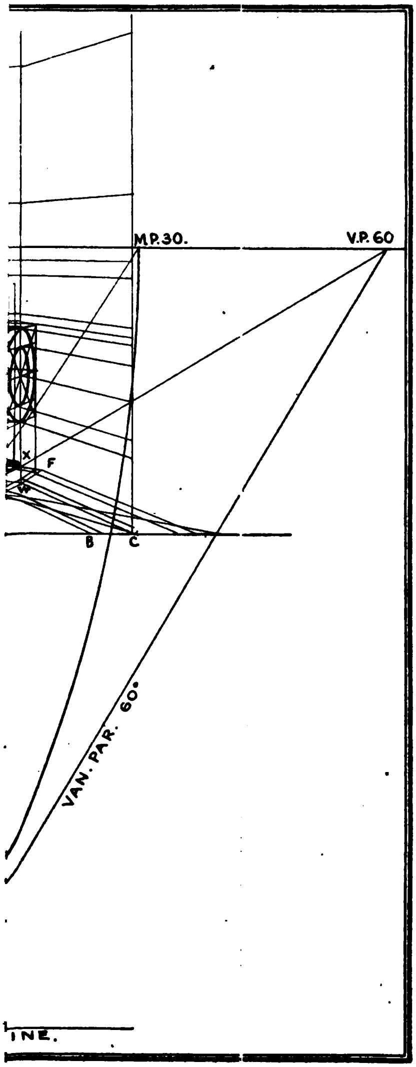
The steam valve on top is a simple problem. The width of the side at top being the same as the side width of base, extend the lines up; as in the front elevation they are a trifle wider, allow for it, which allowance can be judged by the eye. They can be measured, if necessary, but it would be useless, the space is so small. The height of the lines V. W. can also be judged accurately.

The height of the small circle being already found on vertical, and the width being nearly the same as the flat portion upon which it stands, draw in freehand, the same with the farther, small circle.

Next draw in the water end by erecting the necessary vertical lines, and where they intersect the lines running to V. P. 30 will be found most of the points needed. The circular end upon which the yoke is fastened may be drawn without a square; also the far end of water cylinder, as was the farther end of steam cylinder.

Most of the vertical measurements approximate to the vertical measurements on steam cylinder, and should cause no trouble. To find position of air chamber, find the center and the two sides on ground plan and erect perpendiculars; get vertical measurements on the line at C. on G. L. The top and bottom of air chamber can be drawn freehand.

We wish to impress on the student the fact that everything about this pump can be drawn in mathematically, but it would cause much useless labor. It would be simply a case of detail. But in a small drawing, unless absolute mathematical accuracy is required, which in a perspective drawing it never is, such a method of procedure is nothing but a waste of time. All small measurements that might be tedious to make by rule, can always be judged accurately enough by the eye. For practical purposes nothing else is required.



REESE LIBRARY
OF THE
UNIVERSITY
OF CALIFORNIA

PROBLEMS TO BE WORKED OUT.

These problems can all be worked on a sheet of paper 11 x 14 inches.

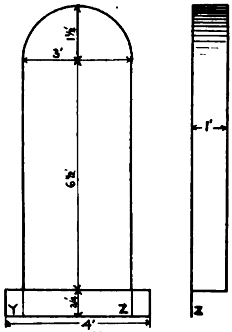


Fig. 1.

1. A slab 7' square by 1½' thick rests on the Ground Plane, its nearest corner is 3' to right of spectator and 2' back of P. P. One side vanishes to right at 50°, the other to left at 40°. On center of slab sits a sphere 5' in diameter. Distance of eye in front of P. P., 11'; height of eye above G. L., 6'. Scale ⅛" to 1'. Place into perspective.

2. Fig. 1 is the front elevation and section of a doorway, all necessary dimensions being marked thereon. The point Z. is 2' to right and 1' back of P. P. The line Z. Y. rests on the ground and vanishes at 50° to left. The eye is 10' in front of P. P. and 5' above G. L. Place into perspective. Scale ½" to 1'.

3. A brick 8"x 4"x 2" lies on the ground on one 8"x 4" face, its nearest corner is 2" to left of spectator and 1" back of P. P. Its 8" side vanishes at 45° to right, its 4" side at 45" to left. On top of this brick lies another, its nearest corner being directly over a point on the ground plane, 1" to right and 2" to back of P. P. Its 8" side vanishes at 40° to left, its 4" side at 50° to right. The spectator is 10" in front of P. P. and 6" above G. L. Place into perspective. Scale ½" to 1".

4. Fig. 2 is the front and side elevation of a cooking range, all dimensions being marked on it. The side Z. Y. vanishes at 35° to left, Z. X. at 55° to right. The point Z. is 3' to right and 1' back of P. P. Place into perspective. Scale ⅛" to 1'. The eye is 10' in front of P. P. and 3½' above G. L.

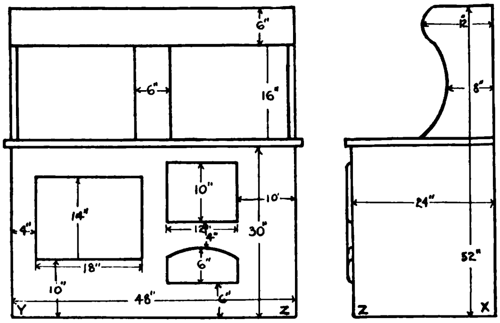


Fig. 2.

5. Fig. 3 is the front and side elevation of a coach house. The corner Z. is 1' to left and 2' back of P. P. The scale is ¼" to 1'. The front Z.Y. vanishes at 35° to right, the side Z. X. at 55° to left. Place into perspective. The eye is 20' in front of P. P. and 8' above G. L.

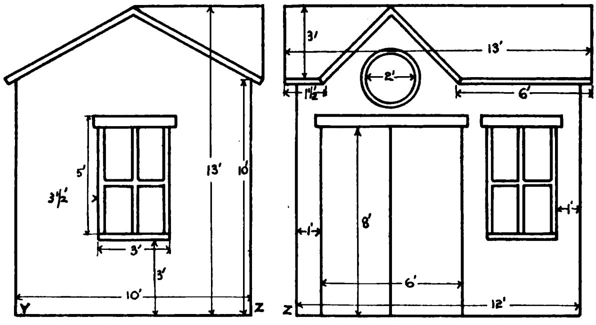


Fig. 3.

GENERAL REMARKS.

It will be noticed that some of the plates in this book, both in Direct and Angular Perspective, appear distorted, and as a matter of fact they are true. The distance of the eye in front of the P. P. has in some cases been made very short. This has been done for the purpose of making the subject as large as possible, and also to prevent unnecessary waste of space. The remedy in all cases that may arise in practical work, if the same defect obtains, is to move the eye farther back, so as to get the Vanishing Point at a greater distance from the object.

In placing an object into perspective, for practical purposes, there is really no need for the minute detail that is shown in some of the plates, simply the position that the object will take being necessary. It can be drawn on a small scale and enlarged to any requisite size later.

There are sometimes slight details in pictures and photographs, that escape any but the trained eye, but which are often of some interest. The following small figures have been drawn to elucidate some of these points and to enable the student to seize upon such in practical work, or when studying a drawing. The cuts have been made in outline, expressly for the purpose of demonstrating certain particular points. All shading has been left out, for, while in some of them a little shadow would have materially helped the effect, if they were intended as pictures, they are made solely for the purpose of explaining the point of vision.

Fig. 1 is a landscape seen from a high window. We recognize at once the fact that the window must be high from the position of the horizon and the distance the front of the picture would have to be brought forward to reach a point of vision directly under the spectator.

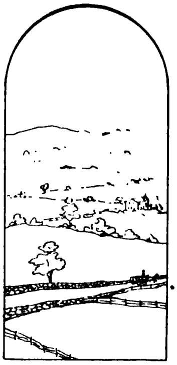


Fig. 1.

With this fact in mind, the road in Fig. 2 will be seen to run down a hill away from us. To get this effect fully, shading would be required in the cut, but the position of the horizon, half way up the tree on the left, shows at once that the spectator occupies an elevated position.

In Fig. 3 the spectator is higher than the little chalet in the foreground, but lower than the mountains; this is easily demonstrated by continuing the vanishing lines of the sides of the house to point A, as shown.

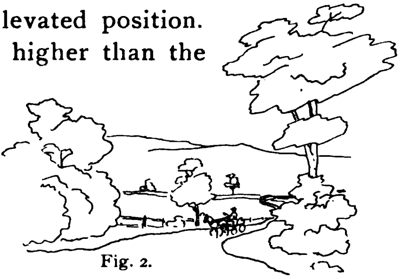


Fig. 2.

In Fig. 4 the spectator is higher than the locomotive, but lower than the telegraph poles. The top of the smoke-stack approximating 15 feet, there is about half that distance between the top and the horizon, which would make the spectator stand at an altitude of about 22 or 23 feet, and would make the telegraph poles about 25 feet high.

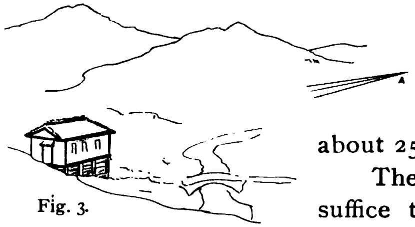


Fig. 3.

The preceding explanations will suffice to show the student how to determine the point of view in nearly any picture he may see. A study of pictures for the purpose of locating the point, will be found very useful. The more it is followed up, the easier it becomes, until it finally amounts to an instinct.

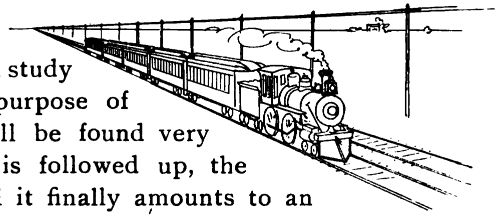


Fig. 4.

REESE LIBRARY
OF THE
UNIVERSITY
OF CALIFORNIA

Berkeley

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

LIBRARY OF THE UNIVERSITY OF CALIFORNIA • LIBRARY OF THE UNIVERSITY OF CALIFORNIA

Berkeley

Berkeley

LIBRARY OF THE UNIVERSITY OF CALIFORNIA • LIBRARY OF THE UNIVERSITY OF CALIFORNIA

Berkeley

Berkeley

LIBRARY OF THE UNIVERSITY OF CALIFORNIA • LIBRARY OF THE UNIVERSITY OF CALIFORNIA

Berkeley

Berkeley

LIBRARY OF THE UNIVERSITY OF CALIFORNIA • LIBRARY OF THE UNIVERSITY OF CALIFORNIA

Berkeley

Berkeley

LIBRARY OF THE UNIVERSITY OF CALIFORNIA • LIBRARY OF THE UNIVERSITY OF CALIFORNIA

Berkeley

Berkeley